Establishing a Framework for Healthy Community Design in Massachusetts

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Abstract

Evolving evidence shows that changes need to be made to the built environment in the United States to reduce the health burden that has developed as a result of a lack of physical activity. The United States is experiencing a chronic disease crisis with the underlying cause for this epidemic being dramatic increases in the proportion of the population who are overweight, obese, or lacking in sufficient levels of physical activity. A directed search of the primary and secondary literature was conducted to identify the various guidelines and standards that have been developed to make recommendations for designing more healthful communities. These guidelines were reviewed and fifteen built environment design elements were selected by the author based on their relevance for the promotion of physical activity. The format of the Design Element documents was created to provide key information to relevant stakeholders during the various stages of the project design and planning processes.

Evaluative feedback on the selected Design Elements was obtained via an on-line survey from professionals from various organizations working to promote physical activity within various organizations in Massachusetts. Most of the feedback was related to the following topics; adding information such as examples of existing projects to the Design Elements, refining the final set of Design Elements, and providing contextual background for users. Suggestions/recommendations were incorporated into the final Design Elements which will be used by the Pioneer Valley Planning Commission as part

of a Healthy Community Design Toolkit being developed for use in Massachusetts to

design more healthful communities.

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Contents

CHAPTER 1: INTRODUCTION AND BACKGROUND

INTRODUCTION

The goal of this M.S. thesis is to develop a framework of active community design

standards for use in community planning and design in the Commonwealth of

Massachusetts. There are a growing number of practices (such as Complete Streets,

Smart Growth, The Leadership in Energy and Environmental Design Green Building™

Neighborhood Design (LEED ND), Safe Routes to School, Active Living Design, Transit-

Oriented Development, Active Transportation, Livable Cities, and Compact

Development) that have as tangible by-products the reconnecting of public health and

planning practitioners. Many of these practices exhibit distinctive differences within a

given discipline, but the main objective is the same: to create a built environment that

supports population health by preventing disease and injury and creating an

environment that supports healthful behaviors.

This thesis will summarize the current state of the practice by reviewing the various

practices, assess the respective benefits and shortcomings of these practices, and

create a tool for local health and planners to be able to better incorporate "active living"

principles within community design. Active living incorporates physical activity into

daily routines, such as commuting to work or getting to school by bicycle or walking to

the grocery store or public library (Active Living Network 2007).   This thesis will have

potential relevance to all residents of Massachusetts because it aims to demonstrate

how to incorporate positive public health impacts into community land-use and

transportation planning decisions. It is also being undertaken at a time when there is

evolving evidence that changes need to be made to reduce the health burden that has

developed as a result of a lack of physical activity ("Healthy People 2020 - Physical

Activity" 2010).

This trend toward physical inactivity can be observed both nationally and at the

state level (Table 1). Massachusetts adults (23.3%) were slightly more likely than U.S.

adults (21%) to meet the minimum aerobic and muscle strengthening exercise

requirements from CDC's 2008 Physical Activity Guidelines for Americans (Centers for

Disease Control and Prevention (CDC) 2011).   In 2008, 20% of Massachusetts adults

reported not participating in any physical activity on a regular basis (Centers for Disease

Control and Prevention (CDC) 2011). This is slightly better than the national average that

same year, when more than 25% of adults reported no regular physical activity (Centers

for Disease Control and Prevention (CDC) 2010b).   Adolescents in Massachusetts aren't

much more active than adults. Twenty-three percent reported not participating in 60

minutes of physical activity in the week prior to taking the survey (Centers for Disease

Control and Prevention (CDC) 2010a).

Physical inactivity not only affects an individual's weight, it is also a risk factor for a

number of chronic diseases, such as heart disease, type 2 diabetes, stroke,

complications of pregnancy, poor birth outcomes, and premature death (Massachusetts

Department of Public Health 2009). In the U.S., the number of individuals diagnosed

with type 2 diabetes, which is associated with a poor diet and lack of exercise, has

nearly tripled from 1995 (7.9 million diagnoses) to 2010 (20.8 million diagnoses).

Massachusetts has also seen an increase in the number of individuals with type 2

diabetes during the same time period although the increase has not been as dramatic.

In 1995, there were 203,000 individuals 18 years of age or older with diabetes living in

Massachusetts. By 2010, this number had nearly doubled to 388,000 ("CDC's Diabetes

Program - Data & Trends - Prevalence of Diabetes - Number (in Millions) of Civilian,

Noninstitutionalized Adults with Diagnosed Diabetes, United States, 1980–2011" 2013).

The underlying cause for many of these chronic diseases is overweight and obesity

(Tulane University 2009). On a national level in the last 20 years, the obesity rates

among children and adults have risen dramatically and continue to remain elevated

(Table 1). Overall, Massachusetts residents are doing slightly better than other

Americans in terms of weight and physical activity, but the potential health impacts of

these data are still staggering. In 2010, more than 33% of American adults were obese

compared to 23% of Massachusetts adults (Centers for Disease Control and Prevention

(CDC) 2012; National Center for Chronic Disease Prevention and Health Promotion

(NCCDPHP) 2012). An individual with a Body Mass Index (BMI) over 30 is considered

obese. Nationally, 34% of adults are considered overweight (BMI of 25 or greater)

(Centers for Disease Control and Prevention (CDC) 2012). In Massachusetts, 60% of

adults are considered overweight (National Center for Chronic Disease Prevention and

Health Promotion (NCCDPHP) 2012). Nearly 12% of American and 11% of

Massachusetts adolescents were obese in 2010 and another 16% and 14%, respectively,

were overweight (Centers for Disease Control and Prevention (CDC) 2010a; National

Center for Chronic Disease Prevention and Health Promotion (NCCDPHP) 2012).

The CDC's release of the 2008 Physical Activity Guidelines prompted the

establishment of physical activity as a major public health goal to address the increasing

burden of chronic disease. Russell Pate followed up on these guidelines by laying out a

National Physical Activity Plan. He notes that the CDC's guidelines, "provide the public

with science-based guidance regarding the types and amounts of physical activity

needed to maintain health and prevent disease. However, as important as they are, the

guidelines do not lay out the changes that will have to be made in our society if most

Americans are to meet the guidelines. That outcome requires a national strategic

planning process aimed at identifying policies, practices, and initiatives that will have

the collective effect of increasing population levels of physical activity" (Pate 2009).

Since that time, a number of guidelines, programs, and initiatives have been developed

both at the national level (those mentioned previously, such as Smart Growth, LEED ND,

and Complete Streets) and within individual states.   Different organizations within

Massachusetts have also developed initiatives to help individuals meet the

recommended physical activity requirements, a few selected examples follow: the

Massachusetts Department of Public Health's (MDPH) Mass in Motion, MA Children at

Play, Working on Wellness Initiative and Keep Moving initiatives, and the City of

Somerville's Shape Up Somerville campaign (Patrick, Murray, and Governor 2013;

Massachusetts Department of Public Health 2013a; Massachusetts Department of

Public Health 2013b; Massachusetts Department of Public Health 2013c; City of

Somerville 2013).

The final outcome of this thesis will be the development of a framework that brings

together guidance from a variety of community planning tools, empirical evidence from

the literature to justify the effectiveness of these design elements for promoting

physical activity, and a qualitative assessment of the relevance of these tools as

obtained from a selected group of thought leaders for use in Massachusetts

communities. The Pioneer Valley Planning Commission, under contract with the MDPH,

will then incorporate the finalized framework into a Healthy Community Design Toolkit

for use in Massachusetts to design more healthful communities.

BACKGROUND

A deliberate shift in community design occurred from the mid-1800s through the

mid- to late-1900s. Prior to that time, public health and the built environment were

necessarily intertwined (Corburn 2004). As the developed world became more

industrialized, people moved into the cities to seek employment and the social

advantages of urban life. The U.S. population grew from 300,000 in 1800 to 54 million

by 1920; and the percentage of the population living in cities increased by about 45%

during this time. Increases in the urban population often resulted in crowded and

unsanitary living condition allowing for increased epidemics of infectious disease, such

as typhus, cholera, smallpox, and yellow fever (Frank, Engelke, and Schmid 2003). The

field of urban planning developed as a public health response to these unhealthy

conditions. Urban design improvements in the built environment such as,

comprehensive sewer systems, the creation of zoning practices which tended to

separate residential and industrial areas, and improved building codes and design, all

contributed to improved public health (Frank, Engelke, and Schmid 2003; Schilling and

Linton 2005). A prevailing view of the time was that people were healthier when

residences and businesses were not in close proximity to one another. The first zoning

ordinances designed to separate building uses occurred in New York City in 1916. Using

the New York City model, the United States Department of Commerce created the

Standard Zoning Enabling Act in 1920. This act gave power to local municipalities to

regulate their own land-use. This principle of local control still underlies most current

zoning ordinances (Schilling and Linton 2005).

By separating residential areas from other land-uses and creating guidelines which

discouraged population density and improved housing stocks, public health experts

succeeded in reducing the burden of infectious disease. As a result of this success, the

two fields of public health and urban design began to diverge and form separate

professional identities and practices. Most recent public health efforts have focused on

behavioral health issues, such as tobacco use or sexually-transmitted diseases, and not

on urban design. Community engineering and planning departments became more

concerned with aesthetics and promoting the local economy and less about population

health (Perdue, Stone, and Gostin 2003).

The trend toward separating land uses became even more pronounced with

innovations in mass transportation. People no longer had to be within walking distance

of their jobs and amenities. Various modes of transportation, such as the horse-drawn

streetcar, the steam ferry, the commuter railroad, and eventually automobiles and

freeways made it possible for people to commute greater distances. The grid design of

streets in cities, which was efficient and logical, was viewed as congested and

unhealthy. Creating healthy cities meant bringing nature and beauty into urban areas.

This was due in large part to the City Beautiful Movement, which featured winding

roads and wide boulevards (Frumkin, Frank, and Jackson 2004). This combination of

change in priorities for community design and the increased dependence on the car, as

the predominate form of transportation, had a huge impact on what is referred to as

collectively as urban "sprawl". Many community designs have, as the center piece, the

single-family home and land ownership as the predominant form of development. Such

design paradigms were built largely for factors which favored cars and not pedestrians

(Frumkin, Frank, and Jackson 2004).

Since the establishment of the Highway Trust Fund in 1956, Federal policies and

funding has focused on the automobile and the development of a roadway system to

accommodate a growing dependence on cars. The Trust Fund shifted Federal spending

from public transportation to the construction of roads. The result has been the creation

of a plethora of auto-centric cities and towns in the U.S. (Lancaster County Planning

Commission 2011). Some examples of auto-centric cities are Atlanta, Los Angeles, and

Houston. Researchers have identified several negative impacts on public health as a

result of this style of community design.

Americans are more affected by chronic diseases than ever before. At the top of

the list are heart disease, cancer and stroke. According to the CDC, these three diseases

account for more than 50% of all deaths each year ("CDC - Chronic Disease - Overview"

2013). Overweight and obesity are risk factors for each of these diseases and the

prevalence of individuals who are either overweight or obese has increased in recent

years. In 2012, over 35% of adults and 15% of children 2-19 years of age were

considered obese (National Institutes of Health 2010; Pan 2012). The Centers for

Disease Control and Prevention (CDC) reports less than half of all Americans did not

meet CDC's 2008 Physical Activity Guidelines for Americans (Haskell et al. 2007). These

guidelines suggest that an adult should perform two hours and thirty minutes of

moderate intensity activity and two hours of strength training per week (US Department

of Health and Human Services 2008). Researchers found that individuals who live in

highly walkable neighborhoods (meaning that they can walk or bike to nearby destinations) get up to 70 more minutes of moderate to vigorous physical activity per week than those who live in low-walkability neighborhoods (Saelens et al. 2003). Additionally, these individuals are far less likely to be overweight or obese when compared to those individuals living in neighborhoods that are not walkable even after controlling for socio-economic status (Active Living Research 2010). In addition to increasing physical activity, the benefits of communities designed in a manner that promote the health of all of its residents include increased heart health, reduced respiratory illness, reduced air pollution, safer streets and injury prevention, reduced crime and increased positive social effects (Johnson and Marko 2009).

In order to create healthy communities a variety of stakeholders within a community or a region need to work together to develop policies that are effective and cohesive. Creating healthy communities requires a variety of stakeholders within a community or a region to work together. In addition to planners and public health practitioners renewing a collaborative exchange, stakeholders should also include city/town engineers, public works staff, school boards, and other relevant community staff and residents (Active Living Leadership 2004). In recent years, a variety of groups or agencies have developed guidelines and recommendations for community design which will allow residents to more efficiently incorporate physical activity into everyday activities, such as commuting or grocery shopping. The principal goal of this thesis will be to conduct a qualitative assessment of the guidelines to identify the most commonly recommended best practices for inclusion in a framework designed to be used in Massachusetts communities. In addition to the review, selected Massachusetts key

informant stakeholders were surveyed to gather information about their practice-based

experiences. Stakeholders were selected from the following constituencies: Public

Health, Land-use and Transportation Planning, Advocacy Groups, and Professional

Organizations.

CHAPTER 2: LITERATURE REVIEW

GUIDELINES USED FOR RECOMMENDATIONS

A comprehensive literature search, supplemented with outreach to practitioners for

additional suggestions, was conducted to identify the various guidelines that have been

developed which make recommendations for designing healthy communities. A list of

the identified guidelines was provided to prevention and wellness staff at the MDPH.

They reviewed the list and identified the guidelines that were deemed to be the most

relevant and appropriate for use in Massachusetts. A narrative description of each of

these (N=8) guidelines is presented below.

New York City Active Design Guidelines: Promoting Physical Activity and Health in Design

(New York City 2010)

These guidelines were developed through collaboration between New York City's

health, planning, design, and architecture communities, as well as national academic

institutions. The guidelines were finalized and released for use in 2010. These

guidelines are a policy initiative meant to be used by city agencies for all building, street

and neighborhood design and construction projects (New York City 2010). The

guidelines propose strategies for interior building design and outdoor spaces that

promote the inclusion of increased physical activity into daily routines. These

guidelines are predominantly relevant for urban and suburban regions and consider all

users (walkers, bikers, individuals with differing capabilities, etc.) in the design

recommendations. The design elements of the guidelines reflect land use mix; transit

and parking; parks, open spaces, and recreational facilities; children's play areas; public

plazas; access to grocery stores and fresh produce; street connectivity; traffic calming;

pedestrian pathways; streetscapes; bicycle networks and connectivity; bikeways; and bicycling infrastructure. For each element objectives are stated and strategies are proposed toward achievement of the objective. For example, to meet the objective of increasing access and the availability of fresh food options, the guidelines propose developing full service grocery stores in walking distance to all residential neighborhoods; including farmers' markets in addition to the grocery stores; and provide safe walking and bicycling routes and appropriate bicycling infrastructure to the grocery stores and farmers' markets.

The choice of recommended strategies as part of these Guidelines was based on review of the best practices in the field and recent academic research. The authors intended for any and all relevant strategies to be incorporated into community development projects to enhance the effectiveness of those projects, while recognizing that each project is unique and that not all strategies will be appropriate. In addition, the authors recommend that this process begin early on in the project programming and scoping phase to identify and minimize potential health problems associated with the project.

San Francisco Better Streets Plan: Policies and Guidelines for the Pedestrian Realm (San Francisco Board of Supervisors 2010)

The San Francisco Better Streets Plan was created through collaboration between the San Francisco Planning Department, Mayor's Office on Disability, Mayor's Office on City Greening, Public Utility Commission, Department of Public Works, Municipal Transportation Agency, and San Francisco County Transportation Authority. It was

adopted by San Francisco's Board of Supervisors on December 7, 2010. This document

presents "unified set of standards, guidelines, and implementation strategies to govern

how the City designs, builds, and maintains its pedestrian environment". It covers the

development of goals and policies; makes recommendations for streetscape design;

provides design specifics for street design and streetscape elements, such as curb

extension dimensions, traffic calming measures and site furnishings; and discusses best

practices for successful implementation.   Some of the highlighted design

recommendations include specifics on incorporating space for public life, such as

neighborhood gatherings; traffic calming measures; distinctive street design; increased

pedestrian safety, including prioritizing pedestrian safety; and increasing flora. This

guidebook is designed to be used during the project planning and design phase by

stakeholders interested in improving the public right-of-ways in San Francisco.

Leadership in Environmental and Energy Design (LEED) for Neighborhood Design (ND)

(Congress for the New Urbanism, Natural Resources Defense Council, and U.S. Green

Building Council 2012)

This document was originally released for use in 2009 and was developed by the

Congress for the New Urbanism, the Natural Resource Defense Council and the U.S.

Green Building Council. It was updated in April 2012. As with other LEED documents,

the LEED ND is a rating system for project performance and includes a project checklist.

It can be used either in the planning phase to inform the design plan or to evaluate and

improve on an existing system. Each of the three sections has certain requirements and

possible points achievable for that section. The three sections are Smart Location and

Linkage (27 points), Neighborhood Pattern and Design (44 points), and Green

Infrastructure and Buildings (29 points). A total of 100 points are attainable and the rating received is based on the projects overall score. A score over 80 certifies the project as platinum, 60-79 is gold, 50-59 is silver, and a score of 40-49 receives base certification. A project may include an entire neighborhood, portion of a neighborhood, or multiple neighborhoods. LEED ND is designed to be used to evaluate and certify specific projects. While some communities may have many LEED ND certified neighborhoods, LEED ND may be applicable to a whole city or town.

LEED ND was designed to be used during the planning and development phase of new neighborhoods, but it is possible to use the rating system on existing neighborhoods.   It was designed for use in urban and suburban communities. LEED ND combines principles of smart growth, New Urbanism and green infrastructure and building and places emphasis on site selection, design and construction elements. According to the LEED ND website, developers who use the LEED ND rating system can expect decreased fees and/or waiting times associated with normal approval processes and higher tenancy rates. The website also suggests that neighboring residents and businesses will have a "good impression" of the project design due to the rigorous environmental nature of the LEED ND certification process ("Neighborhood Development | U.S. Green Building Council" 2013).

Increasing Physical Activity through Community Design: A Guide for Public Health Practitioners (National Center for Bicycling and Walking 2010)

This document was completed in 2010; it is an updated version of a document that was released in 2002. The funding for this project came from the Robert Wood Johnson

Foundation. This document was written for the public health professional and is

designed to prompt conversations between public health practitioners and urban

planners and other city officials. This document provides very general information

about community improvements that can be made. It is heavy on justifications for

these improvements. It recommends determining a starting point through community

audits and prioritizing improvements based on the results. Overall the major strategies

of this tool are to conduct a community infrastructure audit, slow motor vehicle traffic,

create safe and convenient crossings, develop safe routes to school (including changes

in education and encouragement for children and their families and improvements to

the neighboring infrastructure), build more and better sidewalks, make streets more

bicycle friendly, and build more trails. Recommendations are provided as solutions to

each of these "problems". This tool can be used to assess an existing community to

make improvements for proposed developments. It can also be used to affect changes

in policy.

How to Develop a Pedestrian Safety Action Plan (Federal Highway Administration 2008)

In 2004, the U.S. Federal Highway Administration developed a program to address

the high number of pedestrian fatalities in cities and states across the country. One

activity that was part of this goal was to create *How to Develop a Pedestrian Safety*

Action Plan. The document was developed by a contractor for the Federal Highway

Administration's Office of Highway Safety (FHWA/OHS) and the National Highway Traffic

Safety Administration (NHTSA). It was originally released for use in February 2006 and

was updated in May 2008. The guidebook is designed to identify any problematic areas

such as pedestrian sites or roadway segments and suggest appropriate measures to improve safety.

This guidebook was developed using an approach which incorporated the domains of engineering, education and legal enforcement. In addition, it recommends, "making pedestrian-conscious land use decisions". The guidebook is designed to promote collaboration between engineers, educators, planners and enforcement officials to all play a part in identifying and implementing effective safety improvements. The strategies presented are based on other pedestrian safety plans used across the country and research conducted by Federal Highway Administration (FHWA) and the National Cooperative Highway Research Program. It is intended to be used by state and local officials in both the planning and design phase and for identifying existing pedestrian safety issues.

Healthy Communities: The Comprehensive Plan Assessment Tool (Beck 2010)

This tool was created by Claire Beck at the University of Delaware's Institute for Public Administration. It has been in use since August 2010. The document is designed for use by Delaware communities working to develop a comprehensive community plan, but provides useful information for planners and officials of any community.   The document is a checklist of action items which are intended to be included in a community's comprehensive plan. The action items are grouped into five overarching principles. These principles are bicycle and pedestrian accessibility; complete streets; parks and open space; compact and mixed-use design; and convenient access to healthy food. Many of the items on the checklist suggest that the community identify certain

goals, such as placing an emphasis on pedestrian and/or bike facilities, reducing

automobile traffic within the community, or emphasizing parks and recreational

facilities.

The checklist items were selected from a variety of studies identifying best practices

in healthy community development, promoting walkability, and through the

identification of common elements found in a review of existing comprehensive plans

for Delaware communities.

Massachusetts Highway Department Project Development and Design Guide
(Massachusetts Highway Department 2006)

This document was designed by the Massachusetts Highway Department and was

released in 2006. It has won numerous awards for design aspects such as incorporating

non-motorized vehicles into the project development process and its context sensitive

approach. It is required to be used for all projects when MassHighway is the proponent,

or when MassHighway is responsible for the project funding (may be either state or

Federal funding), or when MassHighway controls the infrastructure, such as on a state

highway. The design guide is intended to be a national model for road and bridge

design project and is meant specifically to be used for these two types of projects.

However Chapter 87 of the Massachusetts Acts of 1996 requires all Massachusetts

Highway projects to, "make all reasonable provisions for the accommodation of bicycle

and pedestrian traffic…" and therefore, encourages (requires) the incorporation of

design specifications of bicycle and pedestrian infrastructure. The authors used three

principles for guidance in developing this document. They identified safety and mobility

for all users; context sensitive design (meaning that the project fits within its physical setting) and a transparent design/development process for projects as priorities. This guide provides requirements for all transportation projects in Massachusetts and should be used by anyone involved in both project design and development.

The document provides guidance on project development, basic design controls, horizontal and vertical alignment, cross-section and roadside elements, intersections, interchanges, drainage and erosion control, pavement design, bridges, shared use paths and greenways, intermodal facilities and rest areas, landscape and aesthetics, and wildlife accommodations. Toolboxes are also included to address specific design elements and traffic management strategies. In each section recommendations are given for the inclusion of and requirements for pedestrian and bicycling facilities within each element.

Essential Smart Growth Fixes for Rural Planning, Zoning, and Development Codes
(Environmental Protection Agency 2012)

This document was developed by the U.S. Environmental Protection Agency and was released in February 2012. It is designed to be used to assist rural communities manage new growth in a way that protects the character of the community while encouraging economic prosperity. It is based on Smart Growth Principles and presents strategies appropriate for rural communities. These strategies are; identifying areas for growth and preservation, fiscal impact analysis in development, rural planned unit developments, wastewater infrastructure, rural roads, appropriate development density, use of cluster development for transition, development of policies and

standards that preserve rural character, protection of agriculture and sensitive natural areas, and plan and encourage rural commercial development. For each, the authors present a discussion of related issues, potential responses and the expected outcomes, steps for implementation, pointers and examples. This tool is designed to be used by policy makers and community officials in all types of rural communities and is relevant for changing community policy as well as informing development decisions.

OTHER GUIDELINES

The following are additional guidelines that were suggested for use by MDPH, however upon further review the guidelines were either too narrow in scope to apply to all of Massachusetts or did not provide specific recommendations. The Complete Streets guidelines focus on policy and do not provide the same type detailed information that was in the other guidelines. However an overarching principle of the final recommendations is that future development projects are built with consideration for all users with all abilities, which is the guiding principle of Complete Streets (Smart Growth America 2012). The Safe Routes to School is too specific for this project, but was used for specifics relating to children and access to schools ("National Center for Safe Routes to School" 2013). Transit Oriented Development is also too specific for recommendations for all of Massachusetts, but promotion of the use of transit is a big focus in the final recommendations ("Center for Transit-Oriented Development" 2013). The Healthy Development Measurement Tool was used to provide evidence for the benefits of the some elements ("Sustainable Communities Index - Home" 2013).

CHAPTER 3: METHODOLOGY

SELECTION OF GUIDELINES

As previously mentioned, a comprehensive search was conducted to identify the various guidelines that have been developed which make recommendations for designing healthy communities. This search included a review of local, state and Federal planning and public health agencies as well as international and private organizations that have developed such guidelines. A list of the identified guidelines was provided to prevention and wellness staff at the MDPH. They reviewed the list and identified the guidelines that were deemed to be the most relevant and appropriate for use in Massachusetts. This list was comprised of the following guidelines:

New York City's Active Design Guidelines

San Francisco's Better Streets Plan

Center for Disease Control and Prevention's (CDC) Healthy Places

Federal Highway Administration's Pedestrian Safety Action Plan

Transit-Oriented Development (TOD)

City of San Francisco's Healthy Development Measurement Tool (HDMT)

MA Highway/MA Department of Transportation's Design Guide

Safe Routes to School Program (SRTS)

University of Delaware's Healthy Communities: Comprehensive Plan Tool

Environmental Protection Agency Rural Smart Growth

Leadership in Energy and Environmental Design Neighborhood Development (ND)

Smart Growth America's Complete Streets

All information related to encouraging physical activity through the built environment was mined from these guidelines and compiled into spreadsheets. Using New York City's Active Design Guidelines as a starting point, key design elements (e.g., land use mix, intersection design, public transit, etc.) were identified by the author and MDPH prevention and wellness staff collaboratively from each of the eight guidelines and entered into the spreadsheet. The guideline's objectives and strategies for each design element were then extracted and also entered into the spreadsheet.

FORMULATION AND CREATION OF THE DESIGN ELEMENTS

Selection of the Design Elements

The information for the different built environment design elements was reviewed and fifteen design elements were selected from the eight guidelines based on their significance in the promotion of physical activity.   The selection of design elements was presented to prevention and wellness staff at MDPH and they requested that an additional design element be created which addressed access to grocery stores and fresh produce. A description of each of the sixteen design elements and their relevance to improving the health of a community is presented in Appendix B.

Content of Each Design Element

As previously mentioned, key information on objectives and strategies for each design element was incorporated into the spreadsheets. Once all of the information from the guidelines was extracted, information for each design element was reviewed

individually by the author for possible duplication or overlap with other design elements. Recommendations that were reported in more than one guideline or showed evidence of effectiveness was included in the final draft of the spreadsheet. For ease of use, each design element became its own document as part of a more comprehensive overall "toolkit". For each Design Element[1] the following information is provided:

Definition - this describes to the user how this design element is defined in an appropriate context.

Justification - provides general background information on the relevance of this design element in promoting health through increased physical activity and access to healthy food options.

Evidence - this section provides empirical evidence from peer-reviewed studies of the effect of the design element on increasing physical activity.

Strategies - are the overarching principles for the design element to be effective in increasing physical activity.

Other considerations - are other useful, sometimes context specific, tactics for improving physical activity.

Measurable indicators - gives the user some suggestions for ways to evaluate the impact of the design element in the community.

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[1]In this context, 'design elements' are key aspects of the built environment that play a role in promoting health. 'Design Elements' are a work product of this thesis (see Appendix C).

SURVEY OF KEY BUILT ENVIRONMENT PROFESSIONALS

Once all of the design elements were selected and defined, a survey was designed to obtain feedback from selected key informants. The survey was administered through the use of Survey Monkey, a free on-line survey tool. The individuals who were asked to complete the survey participate in the Massachusetts Partnership for Health Promotion and Chronic Disease Prevention's Built Environment Community of Practice. Members of this practice work in a variety of agencies and organizations within Massachusetts, i.e., the Massachusetts Department of Public Health, the Massachusetts Department of Transportation, the Massachusetts Association of Health Boards, the Massachusetts Municipal Association, and the Massachusetts Public Health Association. In addition, there are members representing regional planning councils, local government, MassBike, WalkBoston, American Heart Association, and some of the 'Mass in Motion' communities.

The survey was designed to have a low respondent burden with a completion time of less than 30 minutes, while still providing useful information for refinement of the Design Elements. The survey contained nine questions; three questions on demographics (multiple-choice) and six questions aimed specifically at the utility of the Design Elements (open-ended). Open-ended questions were used in the survey in order to allow respondents to answer in their own words and to provide as much information and detail as they wanted. The survey and research protocol was reviewed by the Tufts University Social, Educational and Behavioral Institutional Review Board and was deemed to be excluded.

The survey and Design Elements were initially distributed via email to a total of 20 Key Informants on February 8, 2013. The email was resent on February 15, 2013 as a reminder. A final request to complete the survey was sent on February 28, 2013. Documentation of this correspondence and the full survey can be found in Appendix A.

CHAPTER 4: RESULTS

GENERAL PARTICIPANT INFORMATION

A total of 21 responses were obtained. Initial review of job title, employer, and

Internet Protocol (IP) Address identified two respondents who started the survey more

than once. Both respondents completed the first three questions each time but

completed the entire survey only once. Duplicate responses to the partially completed

surveys have been omitted from this analysis. Of the remaining nineteen individuals

only ten responded to the first three questions of the survey which recorded occupation

related data for each respondent. These questions were as follows, the respondent's job

title (Figure 1), the current employer of the respondent (Figure 2), and how long the

respondent had been working in their current field (Figure 3).   Of these 19 individuals,

32% (n=6) are employed in the public health industry sector: five individuals work for a

state health department and one individual reported working for a local public health

agency. Seven individuals reported working for a planning agency (37%): two at a state

planning agency, three at a regional planning agency, and two respondents work at the

local level. Eleven percent and sixteen percent reported working for an advocacy

organizations or other type of professional, respectively. Forty-two percent report

working as a project manager, coordinator, or director; 16% report that their job title is

community liaison; 21% report being planners, 5% work as attorneys, and the remaining

16% are analysts. Fourteen of the 19 individuals have more than five years of

experience in their current occupation: seven of these individuals have been in their

field of expertise for ten or more years.

The entire survey was completed by nine individuals, yielding a participation rate of almost 50% (9/20). Five of these respondents reported working for the state public health agency. Three work for a regional planning agency, and one works for a professional organization. Four individuals have worked in their professional field for 10 or more years, 1 has been in their field for 5-10 years and the other four are relatively new to the field, working less than five years. These nine individuals work in each of the job titles reported above, two analysts, one attorney, two planners, two community liaisons, and two managers/coordinators/directors.

DESIGN ELEMENT QUESTIONS

Respondents, after completing the professional activity questions were then instructed to address the next series of questions by referring to the 16 Design Elements that were in a Zip file attached to the email that contained the link to the survey. They were asked to review each of the Design Elements and then answer questions on each design element.

The first of these questions was, "Of the 16 Design Elements, do you feel any should be eliminated or combined with others?" Respondent responses were mixed for this question. Thirty-three percent (n=3) responded 'no' to this question. Three individuals felt that there may be some value in combining some of the Design Elements. Each of these three individuals had differing opinions relative to how the Design Elements should be combined. Three specific suggestions were made; combine bikeways and bicycle network, bikeways and bike connectivity, and bikeways and shared use paths. One respondent felt that there should be fewer Design Elements, but felt that it would require closer examination to determine which to eliminate or combine. One individual

felt that s(he) needed more information to make a suggestion. The final respondent

stated that, "4 and 5 should be combined", however it is unclear to which elements this

respondent is referring, since the Design Elements were not numbered.

The next question asked respondents, "Do you feel any Design Elements are

missing?" Four respondents answered that there were no missing elements: one

suggested the addition of a Design Element focused on personal safety and another

suggested the addition of a street lighting and street furniture Design Element. Other

comments suggested more detail within the existing Design Elements, such as

addressing street crossing outside of the intersection (i.e., mid-block crossings and

crossing on shared-use paths); signal timing in Intersection Design, and frequency of

service in the Transit Design Element. One respondent suggested creating a Site Design

Element or embedding it within the Land Use Mix Design Element. Another proposed to

expand the Design Element that made recommendations for access to grocery stores

and fresh produce to include all goods and services. One respondent wanted more

information on the relationship of the Design Elements to one another.

The next question asked, "Is it possible to rank the Design Elements in order of

importance?" and if so, "should this be done ". All nine respondents felt that this should

not be done. Some of the reasons given for not ranking the Design Elements were,

"each community is different and may prioritize different elements for different

reasons", ranking them might, "give the impression that there are steps", and, "it would

take away from community flexibility and choice". One respondent suggested that it

could be helpful to identify which, "elements are more relevant to different types of

communities - urban, suburban, rural or older versus newly developing", but acknowledged that, "importance will be different for different places".

A follow up question asked, "Do you feel this would take away from their flexibility to be used by different types of communities?" Eight of the nine respondents all agreed that this would be the case. The ninth individual did not comment on this question.

Next respondents were asked to, "Focus on the general format of the Design Elements", and to, "discuss whether they thought the appropriate information was provided", and, "if they would add any other (content) headings". This question relates to the general content of each Design Element, e.g., definition, justification, measurable indicators, etc. Five respondents stated that they thought the content in each Design Element was sufficient and that it was important to keep the information clear, concise and limited to one or two pages. Two respondents thought it would be helpful to provide examples of success and/or links to project information about those examples. One individual responded that the way they are connected is missing and the last individual had not looked at all of the Design Elements and couldn't comment.

The respondents were asked to answer the next set of questions using their experience as gained through their professional experience with the built environment. The questions asked if respondents had, "Used any of the strategies and other considerations of the Design Elements in their work". If they had they were asked to discuss how effective or successful the strategies and/or considerations were and how that success was measured. Each respondent had a different response to this question. Two individuals stated that they do not have experience with these strategies, but one

of these individuals reported working with communities that are trying to accomplish this work. Another stated that communities in Massachusetts are doing this work, but that the work isn't far enough along to measure success other than whether the project was completed or the policy adopted. One respondent is advocating for these strategies, particularly related to access to healthy food. This individual felt that their work has been very successful and yielded measurable results. One respondent reported working on zoning reform, which incorporates many of these elements. One individual uses the strategies in most of their work and has found varied rates of success. (S)he points out that success often depends on how prepared the project stakeholders are and to some degree on the availability of resources (financial, social and political). This individual agreed with a previous respondent who feels that success is often measured by project implementation or policy change. One individual works with police on enforcement of regulations. Another respondent is collecting data on infrastructure improvements related to these strategies to determine if walking and/or biking have increased in their study area.   The final respondent reports making many recommendations to increase walking and has produced programmatic and marketing materials. This individual also feels that success is currently best seen in policies and project design, but that little data exists.

The final questions asked respondents to feel free to provide any other comments or suggestions below. Five of the nine respondents did not provide any further information. One respondent felt that Mass In Motion communities seem to be having the most success so far working with city management on site plan review policies, community plans, and traffic calming.

CHAPTER 5: DISCUSSION

As discussed previously, there has been a continual increase in the number of individuals in Massachusetts and the country as a whole, both young and old, that are overweight or obese. From the 1980s to 2000, the prevalence of obesity among adults has increased by 80 percent (Oliver 2005). This trend is affecting people from all age, race, and socioeconomic groups. A 1999 study estimated that the annual number of deaths attributable to obesity at that time was 280,000 (Allison 1999). Individuals who are overweight or obese are at greater risk for developing chronic diseases, such as hypertension, gallbladder disease, osteoarthritis, type 2 diabetes, gout, and some types of cancer (Frank, Engelke, and Schmid 2003; Oliver 2005).

Each individual's body weight is determined by diet, physical activity, and metabolic factors, all influenced by genetics (Weinsier et al. 1998). While the effects of overweight and obesity are clear, much research has gone into understanding why the rates have increased so dramatically since the 1980s. Some hypotheses include: increased television viewing (Gortmaker 1996), increased portion sizes (Young and Nestle 2002), rise in fast food consumption (Morrill and Chinn 2004), and an increased participation rate in sedentary or office jobs (Church et al. 2011).

Researchers have also been studying the effects of changes in the built environment on physical activity levels among individuals in the U.S as well. These studies are identifying attributes of community design that promote health and improved wellbeing in the overall population (Papas et al. 2007). From this information, a growing number of recommendations and guidelines have been developed, and will continue to be developed, to disseminate this information to a broader audience. Bringing this

information together into one useful tool can assist Massachusetts communities in making the most informed decisions with regard to the built environment in their community for improving the health of its residents.

Overall, the idea of building healthy communities is a bit of a no-brainer. Why would anyone want to live in an unhealthy community? That said, millions of people in this country live in communities that do not promote their health or wellbeing (Gallup-Healthways 2013). By understanding that health and wellbeing are not just the absence of disease, communities are in a unique position to be able to influence the conditions needed for wellbeing, such as access to goods and services, safety, education, and a sense of community through the strategies and other considerations included in the design elements (O'Connor 2013). As this approach is somewhat new for communities in the U.S., minimal empirical data exist to assess the effectiveness of each of these strategies, but as more communities are implementing the strategies and considerations from the Design Elements, more information will become available to assess the correlation between the built environment and improved health of the population.

Two main themes should be incorporated into the use of the Design Elements. The first is that any design plan should consider all, or at the very least a variety of, potential users for all aspects of a particular project. Making all projects accessible to potential users of all ages and abilities has many benefits for the community. Results from FHWA safety studies show that neighborhoods with sidewalks, raised medians, better bus stop placement, traffic-calming measures, and treatments for disabled travelers improve pedestrian safety. In addition features, such as medians, improve safety for all users by

enabling pedestrians to cross busy roads in two stages, reducing left-turning motorist crashes, and improving bicycle safety ("Highway Safety Improvement Program (HSIP) - FHWA Safety Program" 2013). Other benefits for residents include lowering transportation costs, encouraging walking and biking, and neighborhoods that are welcoming and encourage social engagement (Smart Growth America 2012).

The other important theme is transparency and promoting stakeholder engagement. In order to create healthy communities a variety of stakeholders within a community or a region must work together to develop projects and policies that are effective and cohesive. Creating healthy communities involves reconnecting professionals in the fields of public health and urban planning as well as including city/town engineers, public works staff, school boards, public safety professionals, educators, and other relevant community staff and residents into these processes (Active Living Leadership 2004). Since most of these types of projects will likely be undertaken by some level of government, e.g., municipalities, State or Federal Transportation Agencies, etc.) it is important to have open discussions incorporating stakeholders reflecting the demographics of the community early on in the project planning process. This practice will promote accountability, enhance project effectiveness, and improve the quality of decision-making. All of these different stakeholders are very knowledgeable about their communities and can help identify details that can make the project more successful and accepted within the target community.

After incorporating the survey respondents' suggestions and comments, fifteen Design Elements were finalized (Appendix C). Overall, the respondents' feedback was

positive. Many expressed that the Design Element documents, "looked great",

"provided the appropriate information", and, "were well thought out and designed".

They felt that the Design Elements would, "be useful to cities and towns, residents,

other groups, and organizations" in Massachusetts. One key theme that was repeated

by multiple respondents is the importance of keeping each of the Design Element

documents to one or two pages, making them clear and easy to understand, and

providing references to the material cited. For some of the Design Elements, it was

difficult to find empirical evidence that links its use and effectiveness in promoting

physical activity or resident health. Evidence from peer-reviewed literature was very

limited for the following design elements: Bicycle Infrastructure, Intersection Design,

Street Design, Street Connectivity, Public Plazas and Piazzas, and Shared Use Paths.

While each of these design elements play an important role in creating safe, pedestrian-

and bicycle-friendly neighborhoods, it is likely due to this being a relatively new field of

study and these design elements have yet be studied to the extent that sufficient

quantifiable data would be available at assess each elements direct effect on increasing

physical activity (Clark County Public Health 2010).

Each of the strategies and considerations in the Design Elements are designed to

play a role in improving the health of residents in a community; however the greatest

impacts to health will likely be seen in communities that take a more holistic approach

in their community planning and incorporating as many of the recommendations as

appropriate for the size and type of community (e.g., rural, suburban, urban). It will

then be important for communities to be able to measure the effects of the strategies

and considerations within the Design Element on increasing health and physical activity

at various points during the project's lifespan. A baseline will need to be established

prior to beginning work on the project. In addition to giving a measure of comparison,

this process can also help address additional factors that should be included or

considered in the project plan. This may present a challenge due to lack of available

data; however this is an important step and should not be overlooked. Comparison

measurements should be taken after project completion and then 5, 10, and/or 20 years

as residents become more familiar and comfortable with the new design. Most of the

Design Elements include some suggestions for indicators to measure. While many of

the suggested indicators would measure short-term results, overall the indicators

should have a positive and measurable effect on health. Some of these long-term

measures would include reduced weight, decreased heart attacks and strokes, lower

rates of type 2 diabetes, and reductions in the incidence of some types of cancer.

A discussion of some of the strengths and limitations of this thesis follows below.

One of the strengths of this work was the professional orientation and experience of the

key informants. This group of individuals was selected because of their knowledge and

particular interest in making changes to the built environment to promote physical

activity with the goal of reducing the burden of chronic disease in Massachusetts. Their

input was invaluable throughout the entire process from selecting the guidelines to use,

to creating the Design Elements. They provided important recommendations on the

type of information that should be included in the Design Elements (e.g., the inclusion of

justifications and references). The inclusion of this information makes the Design

Elements more useful by providing information that can be helpful in different stages of

the design and planning processes.

There were some limitations identified with this work. New and different guidelines are regularly being produced and updates are being made to current guidelines. These guidelines may have more recent information and recommendations than the guidelines that were reviewed here. It is likely that much of the information is the same, however some new approaches or concepts will continually be developed. Additionally, a large number of guidelines are already in existence. This review only included a small number of them. There may likely be benefits from including more guidelines. This analysis selected the gudielines that were most well-known, comprehensive, and appropriate to Massachusetts.

In addition to being one of the strengths, the key informants were also a limitation or weakness of this thesis work. There was a great potential for relevant and useful feedback from the survey respondents; this potential was not fully realized given the roughly 50% response rate as calibrated by the completion of the entire survey.   The choice of the survey instrument (Survey Monkey) and its format (few open-ended questions) were selected in this case to try to obtain the highest response rate by reducing respondent burden. It is possible that more information could have been obtained from the respondents if a different technique for surveying (e.g., interviews) was used.

CHAPTER 6: RECOMMENDATIONS

As previously discussed, the Pioneer Valley Planning Commission (PVPC) is developing a Healthy Community Design Toolkit to design more healthful communities. The PVPC is considering incorporating the feedback obtained from the surveys on the Design Elements to ensure that the the toolkit will be as useful as possible for Massachusetts communities.

- Reduce the number of Design Elements by eliminating or combining them where appropriate,

- It may also be helpful for a few different communities (of varying size and type) to pilot test the Design Elements to see if this process naturally eliminates or combines any Design Elements.

- Add Design Elements that focus on personal safety and the addition of a street lighting and street furniture.

  o It is possible that these should be specific Design Elements; however each of these topics are covered within existing Design Elements e.g., pedestrian safety, bicycle infrastructure, and intersection design.

- Add more detail to the existing Design Elements, such as addressing street crossing outside of the intersection (i.e., mid-block crossings and crossing on shared-use paths); signal timing in Intersection Design, and frequency of service in the Transit Design Element.

- Add a Site Design Element or embed it within the Land Use Mix Element.

- This may prove difficult because a Design Element on this topic

  would need to provide information for a variety of different types of

  sites. It may prove to be beyond the scope of what is feasible in this

  type of framework.

- Expand the Grocery Stores and Fresh Produce Retailer Design Element to
  include all goods and services.

  - This recommendation should be considered in the context of land

    use mix or for plazas and piazzas. Access to fresh food and produce

    has been shown to improve community health and should be

    promoted separately from all other goods and services (Zenk et al.

    2006).

- Identify which Design Elements are more relevant to different types of

  communities - urban, suburban, rural or older communities versus those

  areas that are newly developing.

- Add project examples or links to appropriate projects for each Design

  Element.

There were two overarching comments that would improve the overall

effectiveness of the Design Elements for use in Massachusetts communities. One is to

provide general contextual information that connects all of the Design Elements into a

cohesive toolkit. Some examples may include general background information or

context, including who should use the toolkit, a description of how to use the Design

Elements, and additional resources. This information should also encourage and discuss

of the importance of transparency and collaboration among the public and the relevant

agencies.

The other suggestion is the need for more research and data on successes and

failures from communities working on these design elements worldwide in order to

further refine the Design Elements. Once a complete "toolkit" is developed it would be

useful to conduct pilot testing in a few different communities, perhaps using Mass In

Motion communities as test cases. This could help address any gaps and where

additional information or direction is needed. After the Design Elements are refined,

the Pioneer Valley Planning Commission could then promote the toolkits' use missing

some words in all Massachusetts communities for development of Bicycle and

Pedestrian Plans and for City/Town Master Planning.

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TABLES

Table 1. Overweight, Obesity, and Physical Activity in Adults and
Adolescents in the United States and Massachusetts.
2009-2012

		Massachusetts	United States
Adults[1,3,4]	Overweight	60%	34%
	Obesity	23%	33%
Adolescents[2]	Overweight	14%	16%
	Obesity	11%	12%
		Massachusetts	United States
Adults[1,3,4]	Met requirements	23%	21%
	No physical activity	20%	25%
Adolescents[2]	Met requirements	22%	18%
	No physical activity	23%	23%

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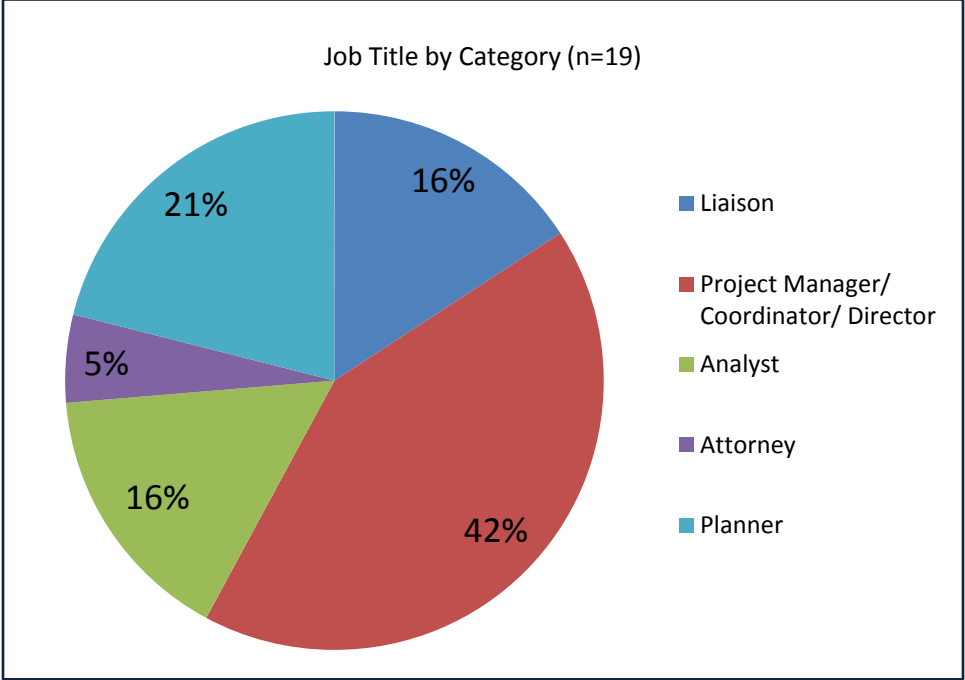
FIGURES

Figure 1. Establishing a Framework for Healthy Community Design in Massachusetts Survey Respondents by Job Title. April, 2013
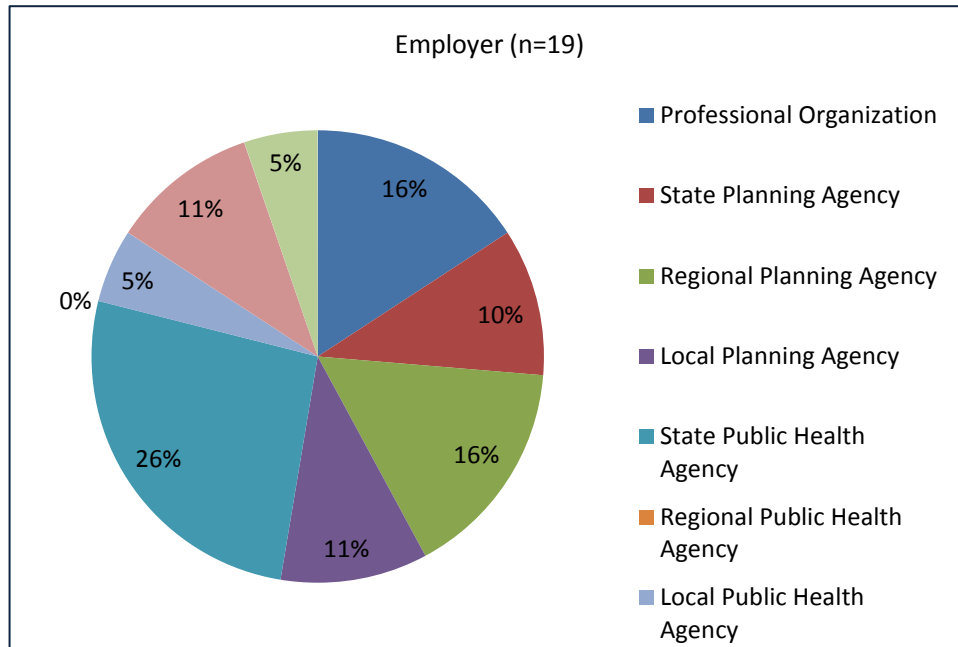
Figure 2. Establishing a Framework for Healthy Community Design in Massachusetts Survey Respondents by Employer. April, 2013
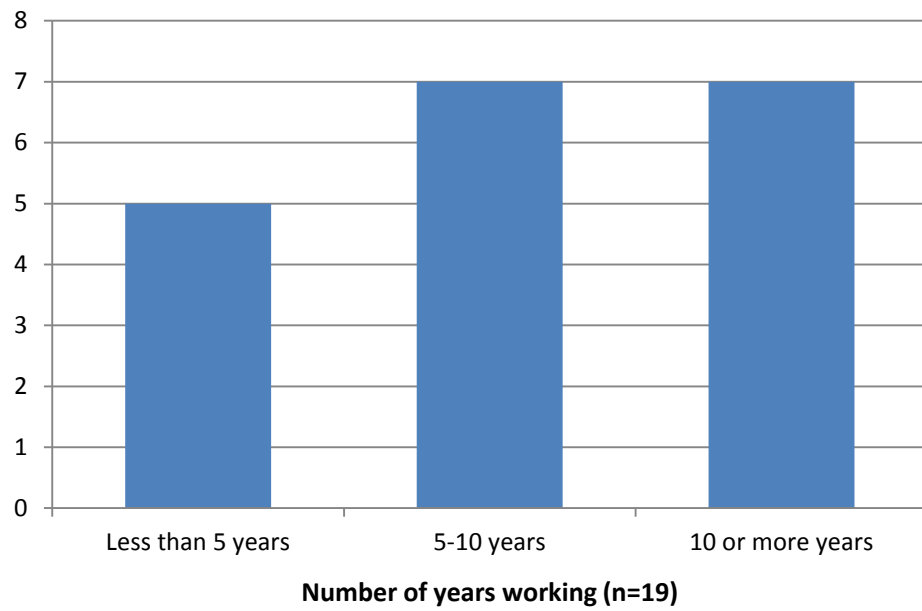
Figure 3. Establishing a Framework for Healthy Community Design in Massachusetts Survey Respondents by Number of Years Working in Their Current Field. April, 2013

APPENDIX A: HEALTHY COMMUNITY DESIGN ELEMENTS SURVEY

Content of the February 15 2013 email to the Massachusetts Coordinated Health Promotion and Chronic Disease Prevention Plan's Built Environment Community of Practice:

Peggy please forward this to all BE CoP members:

Hello everyone, as promised, here is the survey link and the attached Design Elements to review. Please take the time to do this. Thanks!!

http://www.surveymonkey.com/s/TP3DSWC

Explanation from Chris Gorwood:

As part of my thesis work for my Masters in Environmental Health, I have been working with DPH to develop a framework of active community design standards for use in community planning and design in Massachusetts. My research has summarized the state of the practice by reviewing various programs, and creating a tool for local health and planners to use to incorporate active living principles in their own communities.

I have developed drafts of 16 Design Elements based on relevant information identified in a comprehensive literature search. This information was then incorporated into these Design Elements. The type of information included in the matrix includes:

- A definition of the design element

- The role of the design element in increasing physical activity

- Empirical evidence from the literature on the effects on physical activity of the design element

- Key strategies of the design element

- Additional considerations

- Measurable indicators to quantify the effect of the design element

I have taken the Design Elements as far as I can and it would be extremely useful to get feedback from individuals with expertise in community design and public health on their real-world experience with these Design Elements. You will notice that there are a few holes in some of the Design Elements. I have had a hard time identifying relevant measurable indicators for each Design Element.

Please review the Design Elements and complete the short survey that's included. Feel free to provide any and all feedback that you feel should be considered when addressing physical activity in communities in Massachusetts.

Thanks for your time.

http://www.surveymonkey.com/s/TP3DSWC

Christine Gorwood

Content of the February 28 2013 email to the Massachusetts Coordinated Health Promotion and Chronic Disease Prevention Plan's Built Environment Community of Practice:

Hi Peggy,

Would you mind sending this around one more time. I have only received completed surveys from 9 people.

Thanks,
Chris

Here's some updated text:

Hi Everyone,

A huge thank you to those of you who have completed the survey and provide feedback. I really do appreciate your taking the time. I have only gotten completed surveys from about half of you, so if you have started and haven't finished or if you have started, you have the rest of this week to do so.

Here's the link and the previous info that was sent around for your reference.

http://www.surveymonkey.com/s/TP3DSWC

As part of my thesis work for my Masters in Environmental Health, I have been working with DPH to develop a framework of active community design standards for use in community planning and design in Massachusetts. My research has summarized the state of the practice by reviewing various programs, and creating a tool for local health and planners to use to incorporate active living principles in their own communities.

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- Key strategies of the design element

- Additional considerations

- Measurable indicators to quantify the effect of the design element

I have taken the Design Elements as far as I can and it would be extremely useful to get feedback from individuals with expertise in community design and public health on their real-world experience with these Design Elements. You will notice that there are a few holes in some of the Design Elements. I have had a hard time identifying relevant measurable indicators for each Design Element.

Please review the Design Elements and complete the short survey that's included. Feel free to provide any and all feedback that you feel should be considered when addressing physical activity in communities in Massachusetts.

Thanks again for your time.

Christine Gorwood

HEALTHY COMMUNITY DESIGN ELEMENTS

1. What is your job title?

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┌──────────────────────────────────────────────┐
│                                              │
└──────────────────────────────────────────────┘
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2. Who is your employer?

☐   Professional Organization

☐   State Planning Agency

☐   Regional Planning Agency

☐   Local Planning Agency

☐   State Public Health Agency

☐   Regional Public Health Agency

☐   Local Public Health Agency

☐   Advocacy Group

☐   Other (please specify)

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┌──────────────────────────────────────────────┐
│                                              │
└──────────────────────────────────────────────┘
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3. How many years have you worked in your field?

● Less than 5

● 5-10

● 10+

The following questions refer to the 16 Design Elements that were attached to the email with the link to the survey. Please take a look at each of the Design Elements and then answer the remaining questions.

4. Of the 16 Design Elements, do you feel any should any be eliminated or combined with others?

5. Do you feel any Design Elements are missing?

6. Is it possible to rank the Design Elements in order of importance?

a. Should this be done?

b. Do you feel this would take away from their flexibility to be used by different types of

communities?

[text input box]

7. Focusing on the general format of the Design Elements:

a. Is the appropriate information provided?

b. Would you add any other headings?

[text input box]

Please answer the next questions using your experience working with the built

environment.

8. Have you used any of the strategies and other considerations in your work?

a. If so, how effective or successful were they?

b. And how did you measure their success? Please be specific.

[text input box]

9. Please feel free to provide any other comments or suggestions below.

[text input box]

APPENDIX **B:** REFINEMENT OF SCOPE OF EACH DESIGN ELEMENT

Land Use Mix

Land us mix is generally defined as how humans use the surface of the earth. In this context it has a more focused meaning which categorizes these uses and often places regulations on the different classifications within a site or a building (National Association of County and City Health Officials and American Planning Association No Date).   These regulations are often defined locally and vary by use, such as residential, industrial, commercial etc. Studies have shown that well-planned mixed-land use reduces the risk of obesity and associated diseases, asthma, and other chronic diseases (Ewing, Lawrence, and Kreutzer 2006; Baer and Rattray 2007).

Bikeways and Bicycle Network and Connectivity and Bicycle Infrastructure,

Bikeways are any route, street or path that is specifically designated for bicycle travel, bicycle use may be shared or exclusionary (American Association of State Highway and Transportation Officials 1999). On a larger scale, Bicycle Networks and Connectivity refer to a set of bikeways that bicyclists are expected or are advised to use as primary routes. Connectivity refers to the directness of links and the density of connections in a transport network (Australia Healthy Spaces & Places 2009; Mekuria, Furth, and Nixon 2012). The Bicycle Infrastructure Design Element is on a smaller scale and refers to equipment that helps to improve bicycling conditions, such as bike racks, water fountains, or benches. These Design Elements play an important role in the overall promotion of bicycling for physical activity. One study from Tulane University found a 57% increase in adult biking with the addition of on-street bike lanes in New

Orleans. The increase in ridership among females was even more pronounced with an increase of more than 130% (Parker, Gustat, and Rice 2011).

Grocery Stores and Fresh Produce

Grocery Stores and Fresh Produce are included in the Design Elements because of their role in improving resident health. While it may not directly promote physical activity, having nearby access to sources food helps to create a sense of place and can increase the potential for an individual to walk or bike to these locations to pick up a few items, rather than driving to a larger supermarket or a box store. Studies have shown that individuals who live in closer proximity to supermarkets have lower Body Mass Index values and lower rates of obesity and diabetes than individuals who don't have convenient access to fresh foods. This is likely due to the fact that a supermarket in a neighborhood increases residents' consumption of fruits and vegetable (Drewnowski et al. 2012). Morland, Diez Roux and Wing found that individuals who live in proximity to a supermarket have a 9% lower prevalence of overweight, a 24% lower prevalence of obesity, and a 12% lower prevalence of hypertension compared to individuals who do not live near a supermarket (Morland, Diez Roux, and Wing 2006).

Interior Building Design

Interior Building Design is any architectural design element or amenity within a building. This Design Element is included here because Interior building design provides an opportunity to incorporate physical activity into occupants' daily activities. If the average American adult climbed 6-8 flights of stairs per day, they would burn enough calories to prevent average annual weight gain (Nasser 2013). Important strategies for

buildings to promote physical activity include; providing stairs that can accommodate the needs of different users and design them to be more physically comfortable for use; encourage stair use through appealing environments and signage; reduce the emphasis on elevators or escalators to promote use of stairs; locate the building's commonly used functions strategically to promote walking, standing, and wheelchair travel during the course of the day; Increase frequency and duration of recreational and task-oriented walking; design building exteriors and massing that encourage physical activity; and provide building facilities that support recreational and transportation related exercise.

Intersection Design

Intersection Design is an important aspect of street and pedestrian connectivity, as well as, pedestrian safety. This Design Element promotes physical activity by creating route choices for pedestrians and cyclists. It also may encourage physical activity by allowing the user to choose the route most appropriate for their activity or means of conveyance. The general strategy for improved intersection design is to promote pedestrian and cyclist safety, which will encourage walking and biking. Street crossing distances should be minimized while improving pedestrian and cyclist visibility. In addition, vehicle speeds should be reduced when traveling through the intersection.

Parks, Open Space, Children's Play Areas, and Recreational Facilities

Parks, Open Space, Children's Play Areas, and Recreational Facilities have been combined into one Design Element. Collectively they are any land that can be used for enjoying active or passive outdoor activities. This Design Element may refer to a small park, a green buffer on the edge of a street, conservation land or athletic fields

(Massachusetts Executive Office of Energy and Environmental Affairs Division of Conservation Services 2008). A number of studies have shown positive effects among individuals living in proximity to these types of greenspace. The Sustainable Communities Collaborative reports that having access to places to recreate increases the frequency of physical activity. In fact, a 1% increase in greenspace has been shown to increase overall physical activity by 1.4% (Sustainable Communities Collective No Date). Access to greenspace effects are farther reaching than just increased physical activity. Studies have shown that living in proximity to green space reduces the number of self-reported health symptoms and people report better "overall health scores" on surveys; parks and open space can also provide stress relief, particularly to those living in urban areas (Sustainable Communities Collective No Date). A study conducted among residents living at a Chicago Housing Project with greenspace incorporated into the Project's design were better able to handle life's stressors, procrastinated less, and perceived the difficulties in their lives as less troubling than those living in areas without greenspace (Sustainable Communities Collective No Date). Results from another study of women from 5 different states, estimates that every additional fitness facility per 1,000 residents lowers those residents' BMI by 1.39 kg/m^2 (National Center for Bicycling and Walking 2010).

Pedestrian Pathways

Pedestrian Pathways are all routes by which pedestrians may travel. These can include sidewalks, pathways, street crossings, bridges, roadway shoulders, malls, or plazas. Pedestrian pathways should provide direct and easy-to-navigate routes to various destinations. Walking is an inexpensive form of transportation. Improving

pedestrian access to goods, services, and jobs may increase non-auto trips which will have an impact on residents' health, particularly in areas disproportionately affected by poor health ("Sustainable Communities Index - Indicator T.1.b Trips by Non-auto Mode" 2013). Studies have shown that individuals are more likely to walk and take longer walks in neighborhoods that are well connected, have dense residential neighborhoods, have bikeways, and are well lit (Wilson et al. 2011). To promote walking, pedestrian pathways should use design techniques that create safe, efficient, and vibrant pedestrian pathways for recreation and active transportation among individuals of all ages and abilities.

The Massachusetts Highway Department acknowledges that all travelers are pedestrians at some point during their trip and have the potential to be part of every roadway environment. Pedestrians may be regular users of the roadway or may be using the roadway in emergency situations. Planners and designers must understand that every pedestrian is different and the transportation network should protect pedestrian safety (Massachusetts Highway Department 2006). In some areas, particularly areas with a great deal of sprawl, efforts to promote walking could result in increased pedestrian injuries and fatalities. Creating safe environments for pedestrians must be an initial priority for increasing physical activity in communities. Result from Burdette, Wadden and Whitaker show that in a study of nearly 2500 women living in 20 different large U.S. cities the prevalence of obesity was consistently higher in women who reported that they did not feel safe in their neighborhoods (Burdette, Wadden, and Whitaker 2006).

Public Plazas or Piazzas

In the context of this work, a Public Plaza or Piazza is defined as a public space

located in a central area that can be used for civic or commercial purposes. These areas

should be available for multiple uses and have a non-specific design. Public spaces can

be used to create or further develop a sense of place in a neighborhood. They also

provide an open space for congregating and can be a destination location. Pierce et al.

found that people who have walkable destinations near their homes are more likely to

walk 30 minutes per day 5 days per week than people who do not (Pierce et al. 2006).

Ideally, public plazas or piazzas should be accessible to everyone including cyclists and

pedestrians. Such spaces should exclude cars and be safe areas that have enough space

to congregate. Such spaces provide an opportunity to create memorable and vibrant

places for commerce; promote human use and comfort; be ecologically sustainable,

create convenient connections; be attractive, accessible, inviting and well-cared for; and

create attractive and engaging street environments (New York City 2010; San Francisco

Board of Supervisors 2010).

Shared-Use Paths

In this context, Shared-Use Paths are public routes that are physically separated

from motorized vehicular traffic. They are frequently used by bicyclists, pedestrians,

skaters, wheelchair users, joggers and other non-motorized users (American Association

of State Highway and Transportation Officials 1999). Shared-use paths offer the benefit

of providing continuous and extended recreation and transportation opportunities with

a reduction in interactions between users and motorized vehicles. This type of facility

should accommodate users of all abilities. Studies have shown that shared-use paths

have higher rates of usage when they are located in areas of higher population density,

go through areas of commercial use, have healthy trees and plants, and longer lengths

of street segments in the network. Shared-use paths which are in neighborhoods with

the more adults over 64 or children under 5 years of age tend to have lower rates of

usage (Lindsey et al. 2006). Paths are an important part of bicycle and pedestrian

networks and can complement good on-street connectivity. To be most effective these

paths should provide the same connectivity as roadways, but should be separated from

the road (Massachusetts Highway Department 2006). They also provide the potential to

further develop greenways and regional routes that are part of the park system (New

York City 2010).

Street and Streetscape Design

Street and Streetscape Design are defined as the layout and design of individual

streets and street segments, including the street surface; roadway lanes for travel by

vehicle or bicycle; parking; medians; sidewalks; objects on the sidewalks; and all space

up to the private property line (Frank, Engelke, and Schmid 2003). Streets can help

define character of the area. Street design is an important built environment factor

associated with active transportation, especially walking and biking ("Sustainable

Communities Index - Indicator T.1.c Time Spent Walking or Biking" 2013). Important

strategies for improving street and streetscape design include developing a roadway

system that accommodates all users including pedestrians of all abilities, bicyclists,

drivers, and passengers and is appropriate for the street type, i.e., multi-lane boulevard

versus rural back road (Beck 2010; Massachusetts Highway Department 2006; San

Francisco Board of Supervisors 2010). To increase safety of the roadway for all users,

police should focus on improving the compliance of all roadway users with traffic

controls and laws, which may also include slowing vehicle speeds (San Francisco Board

of Supervisors 2010; Federal Highway Administration 2008).

Another key component is to Improve visibility of both pedestrians and motorists

(Federal Highway Administration 2008). Communities should review their development

standards and regulations to identify obstacles to making these changes and

improvements, and determine possible incentives to encourage redevelopment of

property along roadways with existing poor design features (Environmental Protection

Agency 2012). Communities should also provide pedestrian facilities where the need is

the greatest by establishing a routine system to identify gaps in the network along

streets and highways, particularly in urban and suburban areas (Federal Highway

Administration 2008). In addition, future development projects should include

streetscaping aspects and prioritize pedestrian improvements in commercial business

districts to increase business and a sense of place. Finally, street and streetscape design

can be used to create multimodal infrastructure that supports and increases transit

use(Beck 2010).

Traffic Calming

Traffic Calming is the use of design features and strategies to slow vehicle traffic

speeds and volume. Vehicle speed plays a large role in the severity of injuries to the

pedestrian, cyclist, driver and passengers in an accident. Driver reaction time is lowered

and the force of the impact is greater at higher speeds ("Sustainable Communities Index

- Indicator T.2.d Speed Limit Compliance" 2012). Pedestrian injuries can be reduced

more than seven fold by lowering the speed limit from 30 mph to 20 mph. If hit by a car

travelling 40 mph; a pedestrian has an 85% chance of being killed. When the vehicle is

travelling at 30 mph; the chance is reduced to 45%, and the fatality rate drops to about

5% when the vehicle is going 20 mph or slower (Ewing and Dumbaugh 2009; Stair,

Wooten, and Raimi 2008). There are a number of effective methods that can be used to

reduce speed but the overall strategy should be to reduce speed limits to a level

appropriate for the street's context. This means that speed limits should consider the

location of the road, e.g., urban or rural; the individuals who will drive, walk or bike on

that road; and what facilities are present in the area, e.g., public library, hospital,

schools, etc. In addition, reducing the number of motorists speeding on the roadway

will promote walking and bicycling by improving pedestrian and cyclist comfort (New

York City 2010; San Francisco Board of Supervisors 2010; Massachusetts Highway

Department 2006).

Public Transit

Public Transit is the operation of a vehicle for use by the public which has a regular

and consistent schedule and route ("FTA - Research & Technology - Interpretations of

Definitions" 2012). According the American Public Health Association, access to and use

of public transit increases physical activity and improves community cohesion, reduces

pollution as well as fatalities and injuries (American Public Health Association 2012). The

use of public transit can promote community health because it produces less air

pollution per passenger mile than automobiles: 95% less carbon monoxide (CO), 92%

fewer volatile organic compounds (VOC), and about half the carbon dioxide (CO_2) and

nitrogen oxides(NO_x) (American Public Transportation Association and Public

Transportation Partnership for Tomorrow 2002; American Public Transportation

Association 2007). The fatality rate per 100 million miles for public transportation is 1/25th the rate it is for automobiles (American Public Transportation Association 2007). In addition, results from a study in Australia showed that men who used public transit were 45% less likely to be obese or overweight (Zheng 2008).

Some important strategies for public transit to be widely used among the residents of an area include well-connected transit routes that link up with pedestrian routes and sidewalks and provide convenient connections or access to residences, workplaces and other destinations (New York City 2010). Transit stops should be placed on well-connected streets, enhance the experience of waiting for and boarding transit vehicles, and be in areas that are active and visible to maximize safety and security of waiting passengers (San Francisco Board of Supervisors 2010). Consideration should be given to the location of stops, stations, and other intermodal facilities and buildings and their entrances should be located near transit stops and along transit corridors (New York City 2010).

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APPENDIX C: DESIGN ELEMENTS

BICYCLE INFRASTRUCTURE

DEFINITION	For the purpose of these guidelines, bicycle infrastructure does not include bikeways, bike lanes, and bike or shared use paths. Infrastructure is limited to additional provisions such as bicycle storage/racks, bike repair kiosks, water fountains, and benches.
JUSTIFICATION	Providing additional bicycle infrastructure encourages and promotes cycling both as a form of transit and recreation.
EVIDENCE	With the increasing rates of bicycle theft in Massachusetts (up 40% in Brookline, 33% in Somerville and 12% in Cambridge in 2012)[1], providing safe and secure bicycle storage options is a necessity to promote cycling.
STRATEGIES	Increase bicycling for transportation and recreation by providing safe, convenient and well-designed facilities
	Provide indoor and outdoor parking facilities, esp. along routes and at final destinations[2]
	Install bike rails along outdoor stairways to improve connectivity[2]
MEASURABLE INDICATORS	Bike use
	Bike theft

1. I-Team: Bicycle Thefts On The Rise Across Mass. « CBS Boston. at <http://boston.cbslocal.com/2012/10/08/i-team-bicycle-thefts-on-the-rise-across-mass/>
2. New York City. Active Design Guidelines: Promoting Physical Activity and Health in Design. (2010). at <http://centerforactivedesign.org/dl/guidelines.pdf>

Bikeways and Bicycle Connectivity

DEFINITION	Any route, street, or path that bicyclists are expected or are advised to use as primary routes and is specifically designated for bicycle travel, bicycle use may be shared or exclusionary. [1] Connectivity refers to the directness of links and the density of connections in a transport network.[2, 3]
JUSTIFICATION	Bicycling is more likely to replace trips by motor vehicles for transportation because it is faster and able to cover longer distances than walking.
	53% of trips are within a bikeable distance from home (5 miles) but 90% of trips take place by automobile.[4]
	Communities with higher numbers of individuals, who commute by bike, typically have 70% more bikeways per roadway mile.[4]
EVIDENCE	One study in New Orleans found a 57% increase in ridership after the installation of on-street bike lanes, this increase was 133% among females and 44% among males.[5]
	In a study in Portland, OR, cyclists more frequently traveled on roads or routes with bike lanes, separate paths, or bike boulevards.[6]
	Studies have shown that shortest trip distance and riding on road with fewer motor vehicles are the most important factors in choosing cycling routes.[6]
STRATEGIES	Designate bikeways that are appropriate to the street context[7]
	Key design features: uniform widths, bike-safe drainage grates, utility grates flush with the pavement, smooth pavement, traffic signals that can respond to bikes, and adequate site distance[8]
	Encourage biking by creating continuous network of bikeways[7]
OTHER CONSIDERATIONS	Use street markings and signage to separate motorists from bicyclists[7]
	When possible use physical demarcations to separate motorists from bicyclists[7]
	Pay special attention to bikeways at intersections and other points where streets form changes[7]
	Use wide parking lanes (10 ft) to avoid door conflicts[7]
	Sufficient widths for motorists to pass bicyclists without changing lanes[8]
	Remove roadway obstacles[8]
	Designate bicycle specific crossings and signals to organize movements of various users[7]

OTHER CONSIDERATIONS CONTINUED	Expand existing bikeways where use has exceeded capacity[7]	
	Direct bicyclists to scenic or low traffic routes with signage or pavement markings[8]	
	Signalized crossing of major roads for those not comfortable making turns in traffic[8]	
	Cyclists are subject to same traffic rules as motor vehicles[8]	
	Bike lane widths, 4 ft min, 5-6 ft desirable[8]	
	Community goal that emphasizes bike facilities[9]	
	Goal to enhance kids bike safety and start or enhance SRTS program[9]	
	May conduct bike study[9]	
	Create bicycle plan[9]	
	Prioritize bike improvements[9]	
	Create and backbone of unbroken thru-routes with interconnected bikeways (bike lanes, side street bike routes and shared use paths)[7]	
	Create links between bicycling and transit[7]	
	Provide bike route signage with direction, distances, and times to various services and destinations[7]	
	Promote biking on roads with lower vehicle volume and speed[8]	
MEASURABLE INDICATORS	Miles of bikeway	
	Increased ridership	

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2. Australia Healthy Spaces & Places. Design Principle-Connectivity and Permeability. (2009). at <http://www.healthyplaces.org.au/userfiles/file/Connectivity%20June09.pdf>
3. Mekuria, M., Furth, P. & Nixon, H. *Low-Stress Bicycling and Network Connectivity*. 68 (2012). at <http://transweb.sjsu.edu/PDFs/research/1005-low-stress-bicycling-network-connectivity.pdf>
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9. Beck, C. Healthy Communities: the Comprehensive Plan Assessment Tool. (2010). at <http://www.ipa.udel.edu/healthydetoolkit/docs/CompPlanAssessmentTool.pdf>

Grocery Stores and Fresh Produce Retailer

DEFINITION	A farmers market or a retail establishment with a North American Industry Classification System (NACIS) code of 445110 (Supermarkets and Other Grocery Stores, excludes Convenience Stores) or 445230 (Fruits and Vegetable Markets).[1]
JUSTIFICATION	Studies have shown that individuals living in closer proximity to supermarkets have lower BMI values and lower rates of obesity and diabetes.[2]
EVIDENCE	Having a supermarket in a neighborhood increases residents' consumption of fruits and vegetable.
	Individuals who live in proximity to a supermarket have a 9% lower prevalence of **overweight**, a 24% lower prevalence of **obesity**, and a 12% lower prevalence of **hypertension** compared to individuals who do not live near a supermarket.[3]
STRATEGIES	Every resident should have convenient access to healthy food retailers. These locations should be accessible by pedestrians, bikes, cars, and public transit.
OTHER CONSIDERATIONS	Develop full service grocery stores in walking distance to all residential neighborhoods.[4]
	Encourage farmers markets[4]
	Provide safe routes of access for bikes and pedestrians[4]
	Require appropriate outdoor space to accommodate people with all abilities, pedestrian and bike infrastructure (water fountains, benches, bike racks), delivery vehicles, and limited parking.[4]
MEASURABLE INDICATORS	Create a map of the location of current retailers. Update annually.
	Percentage of people meeting fruit and veggie intake recommendations

1. Forsyth, A. *et al.* Design for Health www. designforhealth. net. (2008). at <http://208.106.193.160/pdfs/HIA/BCBS_HIAThreshold4.0_063008.pdf>
2. Drewnowski, A., Aggarwal, A., Hurvitz, P. M., Monsivais, P. & Moudon, A. V. Obesity and Supermarket Access: Proximity or Price? *American Journal of Public Health* **102,** e74–e80 (2012).

3. Morland, K., Diez Roux, A. V. & Wing, S. Supermarkets, Other Food Stores, and Obesity. *American Journal of Preventive Medicine* **30,** 333–339 (2006).
4. New York City. Active Design Guidelines: Promoting Physical Activity and Health in Design. (2010). at <http://centerforactivedesign.org/dl/guidelines.pdf>

INTERIOR BUILDING DESIGN[1]	
DEFINITION	Any architectural design elements and amenities within a building.
JUSTIFICATION	Interior building design provides an opportunity to incorporate physical activity into occupants' daily activities.
EVIDENCE	If the average American adult climbed 6-8 flights of stairs per day, they would burn enough calories to prevent average annual weight gain.[2]
STRATEGIES	Incorporate physical activity in regular daily activities
	Provide stairs that can accommodate the needs of different users and design them to be more physically comfortable for use
	Encourage stair use through appealing environments and signage
	Reduce the emphasis in elevators or escalators to promote use of stairs
	Locate the building's commonly used functions strategically to promote walking, standing, and wheelchair travel during the course of the day
	Increase frequency and duration of recreational and task-oriented walking
	Design building exteriors and massing that encourage physical activity
	Provide building facilities that support recreational and transportation related exercise.
OTHER CONSIDERATIONS	Provide one or all stairs in the building for everyday use, can be a grand stairway or fire stairs
	Focus on stairs, not elevators, as the principal means of vertical travel
	In high rises, provide access so that the stairs are used for trips to adjacent floors and elevators are only used for vertical travel of 4 or more floors

OTHER CONSIDERATIONS CONTINUED	Integrate stairs with the principal areas of orientation and travel in the building
	Make stairs accessible to the public areas of the buildings and remove locks
	Locate stairs near the building entrance
	Locate stairs designed for everyday use near the elevators
	Locate an appealing, visible stair directly on the buildings principal paths of travel
	Design stairs to be more visible to encourage everyday use; egress can be made more visible by: using fire-rated glass enclosures, rather than typical opaque ones; open stairs way between two or more floors when possible
	Make stairs wide enough for travel in groups and in two directions
	Design stair risers that are comfortable and safe
	Use articulated and unique stair composition to promote interest in stair use-two strategies: grand, sculptural staircases and exciting stair construction
	Provide visually appealing interior finishes, create continuity between stairs and adjoining spaces
	Design stair environments that appeal to the senses: highlight interesting views; incorporate artwork; add music; incorporate natural ventilation; select bright and inviting
	Design safe stairs by: provide slip resistant floor finishes; provide color or textural contrasts at tread nosings for safety
	Provide well-lit stair environments that encourage use by: incorporating natural daylight into the stair environment; provide illumination levels equal of greater than 75% of adjacent areas and with a minimum of 10 foot-candles illumination within the stair
	Design stairs to be easily maintained, long lasting materials, finishes that are easy to clean and maintain and resist wear and tear
	Place informational signage in areas where people have to choose type of vertical travel
	Locate stair prompts where they will be most visible
	Design informational and motivational messages to be linguistically, culturally and age appropriate to the building's users

OTHER CONSIDERATIONS CONTINUED	Design elevators to be less prominent than the stairs for people who can use the stairs while providing elevator access for people with disabilities by: locating elevators out of direct site of the building's entrance; do not program the elevators to return to the ground floor with the doors open; refrain from visually highlighting the elevator while emphasizing the stairs; consider creating a second floor lobby accessible by the first floor; consider limiting size, speed, and capacity of elevators in low rise buildings, if possible; consider installing skip-stop elevators
	Use signage at elevators and escalators to show where the stairs are and encourage their use
	Limit the use of escalators in buildings using the following strategies: limit escalator use to rush hour; slow escalators during non-rush hours; retrofit existing escalators with motion sensor activation devices to both discourage use and save energy
	Consider locating shared functions on alternative floors adjacent to staircases or ramps
	When arranging a building's programs, consider the capacitates and ages of the buildings inhabitants
	Encourage personal interactions in addition to electronic communications
	Provide appealing environments along paths of travel
	Provide daylight along paths of travel
	Provide supportive infrastructure
	Provide information about walking routes and around the building
	Consider providing incremental distance markers so people can judge the amount of walking they've done
	Include physical activity spaces in commercial workplaces and residential buildings
	Locate physical activity spaces in centrally visible locations in the building to increase awareness and use of these spaces
	Provide views to the outdoors from physical activity rooms
	Provide shower and locker room facilities
	Provide secure sheltered and accessible bicycle storage
	Provide informational boards and signage about facilities, services, and groups related to physical activities

MEASURABLE INDICATORS

1.New York City. Active Design Guidelines: Promoting Physical Activity and Health in Design. (2010). at
<http://centerforactivedesign.org/dl/guidelines.pdf>

2.Active design in offices gets workers to move. at
<http://www.usatoday.com/story/money/business/2012/10/28/active-design-obesity-offices/1657075/>

INTERSECTION DESIGN

DEFINITION	The area where two or more streets join or cross at-grade. Intersection design should consider all modes of travel, including the pedestrian, cyclist, motor vehicle, and transit.[1]
JUSTIFICATION	Intersection design plays a large role in a pedestrian's or cyclist's route choice by affecting a user's perception of travel safety.
EVIDENCE	A study of nearly 2500 women living in 20 different large U.S. cities found that the prevalence of obesity was consistently higher in women who reported that they did not feel safe in their neighborhoods.[2]
STRATEGIES	The intersection should promote pedestrian and cyclist safety, encourage walking and biking, minimize crossing distance, and maximize pedestrian and cyclist visibility and slow traffic while traveling through the intersection.
OTHER CONSIDERATIONS	Promote and enforce road rules compliance for all users.[3]
	General design strategies: increase intersection density, parking restrictions at corners, tight turn radii, traffic calming features, roadway lighting, streetscape elements, accessible transit stops, street trees, landscaping and other site furnishings.[1,4,5]
	Pedestrian-specific design strategies; highly visible crosswalks, crossing aids, curb extensions, median refuges, pedestrian lighting, curb ramps, and seating. [1,4]
	Cyclist-specific design strategies: bike boxes or advanced stop lines, cyclist-activated traffic lights, and the presence of bicycle signage. [5,6]
MEASURABLE INDICATORS	Number of intersections per square mile.

1. Massachusetts Highway Department. Massachusetts Highway Department Project Development and Design Guide. (2006). at <http://www.mhd.state.ma.us/default.asp?pgid=content/designGuide&sid=about>
2. Burdette, H. L., Wadden, T. A. & Whitaker, R. C. Neighborhood Safety, Collective Efficacy, and Obesity in Women with Young Children*. *Obesity* **14,** 518–525 (2006).

3. Lange, F., Haiduk, M., Schwarze, A. & Eggert, F. The dark side of stimulus control—Associations between contradictory stimulus configurations and pedestrians' and cyclists' illegal street crossing behavior. *Accident Analysis & Prevention* **43,** 2166–2172 (2011).
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5. Winters, M., Brauer, M., Setton, E. M. & Teschke, K. Built Environment Influences on Healthy Transportation Choices: Bicycling versus Driving. *Journal of Urban Health* **87,** 969–993 (2010).
6. Dill, J., Monsere, C. M. & McNeil, N. Evaluation of bike boxes at signalized intersections. *Accident Analysis & Prevention* **44,** 126–134 (2012).

LAND USE MIX

DEFINITION	Land use is typically controlled by local codes which regulate the use and development of land within a community. Mixed land use incorporates a variety of land use types (i.e., residential, commercial, office, open space, etc) into the same area or within a development.[1]
JUSTIFICATION	People living in communities with mixed land use are likely to get 30 minutes of physical activity per day. These individuals are more likely to walk or a ride a bike for transportation purposes and have less need to drive a car.[2,3]
EVIDENCE	Increased transit rides, walking, biking and physical activity in general in areas with mixed land use.[2]
	Each additional type of destination in an area may increase walking for transport by 5 min per week[4]
	Reduction in vehicle miles traveled, vehicle accidents, and vehicle emissions[3]
	Reduction in risk of obesity and associated diseases, asthma, and other chronic diseases [3, 5]
	Increased neighborhood safety, improved sense of community, and reduced violence[5]
STRATEGIES	Diverse mix; variety of low-intensity industrial uses, residences, shops and services; compact and mixed use development with context sensitivity; focus on pedestrian safety; values of the community should be fully considered; designs/projects should keep with the character of the area
	Create destinations within walking distance of where people live and work[6, 7]
	Projects should have lasting added value to the community, be usable by everyone, and accessible to everyone[8]
	Recommendations for traditional neighborhood development ordinances[9]
	Should preserve environmental, scenic, aesthetic, historic, built and natural resources of the area[8, 10]
	Create a process for all community staff to review plans, codes and policies[10]
	Should be context sensitive[8, 10]

OTHER CONSIDERATIONS	Create a comprehensive land use map that IDs preferred development areas and describes desired use mix, key features and community design principles
	Review existing land use codes to determine if they need revision[10]
	Avoid zoning "leapfrogging" i.e., residential then commercial, etc.[10]
	Specify preferred locations for open space, create continuous open space, preserve views and limit impacts[10]
	Consider vertical and horizontal land use mixing
	Get buy in from a variety of constituents early on in the planning process[8, 10]
MEASURABLE INDICATORS	Modification to zoning language
	Percentage of residents who walk or bike for transportation[2]
	Number of vehicle miles traveled[2]
	Improved health community health, reduced obesity, asthma, heart disease rates etc.

Shading indicates strong evidence

1. CDC - Healthy Places - Healthy Places Terminology. at <http://www.cdc.gov/healthyplaces/terminology.htm>
2. Stair, P., Wooten, H. & Raimi, M. How to create and implement healthy general plans. (2008). at <http://changelabsolutions.org/sites/default/files/Healthy_General_Plans_Toolkit_Updated_20120517_0.pdf>
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4. McCormack, G. R., Giles-Corti, B. & Bulsara, M. The relationship between destination proximity, destination mix and physical activity behaviors. *Preventive Medicine* **46,** 33–40 (2008).
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6. Federal Highway Administration. How to Develop a Pedestrain Safety Action Plan. (2008). at <http://safety.fhwa.dot.gov/ped_bike/ped_focus/docs/fhwasa0512.pdf>
7. New York City. Active Design Guidelines: Promoting Physical Activity and Health in Design. (2010). at <http://centerforactivedesign.org/dl/guidelines.pdf>
8. Massachusetts Highway Department. Massachusetts Highway Department Project Development and Design Guide. (2006). at <http://www.mhd.state.ma.us/default.asp?pgid=content/designGuide&sid=about>
9. Beck, C. Healthy Communities: the Comprehensive Plan Assessment Tool. (2010). at <http://www.ipa.udel.edu/healthydetoolkit/docs/CompPlanAssessmentTool.pdf>
10. Environmental Protection Agency. *Essential Smart Growth Fixes for Rural Planning, Zoning, and Development Codes*. 52 (2012). at <http://www.epa.gov/dced/pdf/rural_essential_fixes_508_030612.pdf>

PARKS, OPEN SPACE, CHILDREN'S PLAY AREAS, AND RECREATIONAL FACILITIES

DEFINITION	This can be any land that is used for enjoying active or passive outdoor activities. These terms may refer to a small park, a green buffer on the edge of a street, conservation land or athletic fields.[1]
JUSTIFICATION	Having access to places to recreate increases the frequency of physical activity.[2]
	Living in proximity to green space reduces the number of self-reported health symptoms and people report better 'overall health scores' on surveys.[2]
	Parks and open space provide stress relief, particularly to those living in urban areas.[2]
EVIDENCE	A 1% increase in greenspace can increase physical activity by 1.4%.[2]
	One study from Chicago showed people who lived in a housing project with greenspace were better able to handle life's stressors, procrastinated less, and perceived the difficulties in their lives as less troubling than those living in areas without greenspace.[2]
	Results of study of women from 5 different states, estimates that every additional fitness facility per 1,000 residents lowers resident BMI by 1.39 kg/m^2.[3]
STRATEGIES	Should be designed and located in areas able to be used by all residents. Should increase active and passive recreational opportunities which promotes physical activity, enhances outdoor space and visual attractiveness, improves air quality, and can create habitat protection programs.[4,5,6,7]
OTHER CONSIDERATIONS	Open space should be included in large scale design projects[4]
	Buildings should be located in proximity to open space[4]
	Make bike/ped routes visible and safe[4]
	Aggregate open space into larger areas within 10 min walk[4]
	Provide facilities in open spaces such as tracks, playgrounds, benches, water fountains, etc[4]
	In commercial development areas include walking paths and/or exercise facilities [4]
	Consider culture in park and open space design[4]

OTHER CONSIDERATIONS CONTINUED	Accommodate a wide variety of users[4]
	Create relationships with organizations to sponsor and maintain green space and gardens[4]
	Green space can be provided on sidewalks, in median parks, on boulevards, pedestrian only streets, public stairs, etc[5]
	Community goal that emphasizes parks and rec facilities[6]
	Recommend open space policies and conservation oriented land use plans[6]
	Identify high value agricultural lands and sensitive areas[7]
	Use courtyards, gardens, terraces, and roofs for outdoor play areas for children[4]
	Clearly indicate areas for sporting activities[4]
	Preserve or create natural terrain[4]
	Include lighting to extend hours of activity[4]
	Consider weather in design elements (e.g., wind protection, cooling areas)[4]
	Provide physical activity at school[4]
	Design school facilities for use after school and on weekends[4]
MEASURABLE INDICATORS	Acres of open space for every 1,000 residents.

1. Massachusetts Executive Office of Energy and Environmental Affairs Division of Conservation Services. Open space and Recreation Planner's Workbook. (2008). at <http://www.mass.gov/eea/docs/eea/dcs/osrp-workbook08.pdf>
2. Sustainable Communities Collective. Increase Park, Open Space and Recreation Facilities. (No Date). at <http://www.sustainablesf.org/objectives/standards/59>
3. National Center for Bicycling and Walking. Increasing Physical Activity Through Community Design; a Guide for Public Health Practitioners and Livable Community Advocates. (2010). at <http://www.bikewalk.org/pdfs/2010/IPA_full.pdf>
4. New York City. Active Design Guidelines: Promoting Physical Activity and Health in Design. (2010). at <http://centerforactivedesign.org/dl/guidelines.pdf>
5. San Francisco Board of Supervisors. San Francisco Better Streets Plan: Policies and Guidelines for the Pedestrian Realm. (2010). at <http://www.sf-planning.org/ftp/BetterStreets/proposals.htm#Final_Plan>
6. Beck, C. Healthy Communities: the Comprehensive Plan Assessment Tool. (2010). at <http://www.ipa.udel.edu/healthydetoolkit/docs/CompPlanAssessmentTool.pdf>
7. Environmental Protection Agency. *Essential Smart Growth Fixes for Rural Planning, Zoning, and Development Codes*. 52 (2012). at <http://www.epa.gov/dced/pdf/rural_essential_fixes_508_030612.pdf>

Pedestrian Pathways

Definition	Routes by which pedestrians travel, may include sidewalks, pathways, street crossings, bridges, roadway shoulders, malls, or plazas. Pedestrian pathways should provide straight and easy-to-navigate routes to destinations.
Justification	Walking and biking are relatively inexpensive forms of transportation. Improving pedestrian access to goods, services, and jobs may increase non-auto trips which will have an impact on residents' health, particularly in areas disproportionately affected by poor health.[1]
Evidence	Studies show that individuals are more likely to walk and take longer walks in neighborhoods that are well connected, have dense residential neighborhoods, have bikeways, and are well lit.[2]
Strategies	Use design techniques to create safe, vibrant pedestrian pathways to encourage walking for recreation and active transportation among individuals of all ages and abilities.
Other Considerations	Create a buffer to protect peds from motor vehicles using trees, street furniture, and other infrastructure[3]
	Provide seating, drinking water fountains, rest rooms, and other infrastructure that Support frequency and duration of walking[3]
	Organize ped-oriented programs, charity walks vehicular street closings[3]
	Provide lighting on streets and paths[3]
	Provide trees and/or other sources of shade[3]
	Make sidewalk widths consistent with their uses, e.g., strollers near school[3]
	Enhance midblock and intersection crosswalks[3]
	Enhance curb extensions where sidewalk traffic is greater[3]
	In developments use pathways to extend sidewalks[3]
	Create or orient paths toward interesting views[3]
	Provide signage for way finding[3]

OTHER CONSIDERATIONS CONTINUED	Support physical activity among people with disabilities by making streets and paths universally accessible[3]	
	Walking paths should have smooth, stable, slip-resistant surfaces that do not cause vibration in wheelchairs and are free of tripping hazards[4]	
	Sidewalks should be present in all areas surrounding schools, libraries, parts and commercial areas and between transit stops[5]	
	Sidewalk widths should be between 5 and 12 feet depending on their location and the road[4]	
	Sidewalks should have raised curbs and cut ramps in urban and suburban areas[4]	
	Landscaped buffers between vehicles and pedestrians increases safety and comfort[4]	
	Curbs aren't necessary in rural areas[4]	
	Continuous sidewalks on both sides of the roadway, if only on one side consideration should be given to minimize street crossings and sidewalks should be provided at reasonable intervals[4]	
	Where pedestrian traffic is low or vehicle volume and speed are low, 4 foot paved shoulders may be used[4]	
	Have a community goal to emphasize pedestrian facilities and prioritize pedestrian improvements, include Safe Routes to School and child safety programs.[6]	
MEASURABLE INDICATORS	Measure pedestrian usage	

Shading indicates Emerging Evidence

Shading indicates Best Practice

One-Mile Walk in a Compact Neighborhood
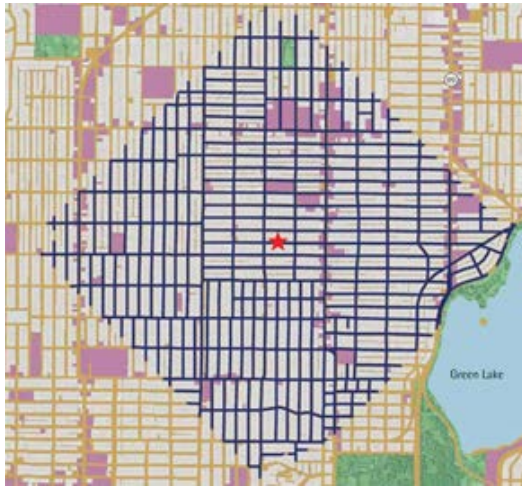
A one-mile walk in Seattle's Phinney Ridge takes you through a grid-like street network with a mix of residences and businesses

Maps courtesy of [Lawrence Frank & Co](). and the [Sightline Institute]()

One-Mile Walk in a Sprawling Suburb

A one-mile walk in Bellevue, WA with cul-de-sacs and winding streets has few shops and services within walking distance.

1. Sustainable Communities Index - Indicator T.1.b Trips by non-auto mode. at <http://www.sustainablesf.org/indicators/view/43>
2. Wilson, L.-A. M. *et al.* The association between objectively measured neighborhood features and walking in middle-aged adults. *Am J Health Promot* **25,** e12–21 (2011).
3. New York City. Active Design Guidelines: Promoting Physical Activity and Health in Design. (2010). at <http://centerforactivedesign.org/dl/guidelines.pdf>
4. Massachusetts Highway Department. Massachusetts Highway Department Project Development and Design Guide. (2006). at <http://www.mhd.state.ma.us/default.asp?pgid=content/designGuide&sid=about>
5. San Francisco Board of Supervisors. San Francisco Better Streets Plan: Policies and Guidelines for the Pedestrian Realm. (2010). at <http://www.sf-planning.org/ftp/BetterStreets/proposals.htm#Final_Plan>
6. Beck, C. Healthy Communities: the Comprehensive Plan Assessment Tool. (2010). at <http://www.ipa.udel.edu/healthydetoolkit/docs/CompPlanAssessmentTool.pdf>

PEDESTRIAN SAFETY

DEFINITION	The MA Highway Department acknowledges that all travelers are pedestrians at some point during their trip and may be part of every roadway environment. Pedestrians may be regular users of the roadway or may be using the roadway in emergency situations. Planners and designers must understand that every pedestrian is different and the transportation network should protect their safety.[1]
JUSTIFICATION	Promoting walking in areas of sprawl may increase pedestrian injuries and fatalities. Creating safe environments for pedestrians must be a priority to increase physical activity in communities.
EVIDENCE	A study of nearly 2500 women living in 20 different large U.S. cities found that the prevalence of obesity was consistently higher in women who reported that they did not feel safe in their neighborhoods.[2]
STRATEGIES	Guidelines and policies should apply to both private and agency built projects
OTHER CONSIDERATION	Paved shoulders in rural areas
	Sidewalks should be well-defined and continue through driveways, double sided lighting to illuminate streets and sidewalks, pedestrian crossing islands, 2 stage crosswalk with median fencing, curb extensions, advance stop bars/yield lines, traffic signals with pedestrian signal at crosswalks, tighter turn radii, curb ramps with proper placement, prohibited 'right on red' at high pedestrian traffic intersections, and reduced travel speed and number of lanes
	Children perceive their environment differently than adults, may not be able to judge how drivers will behave, typically walk slower due to their shorter gait, have lower eye height, and may be harder to see because of their shorter height.[1]
	All pathways should have firm, stable, slip-resistant surface in a wide variety of use and weather conditions[1]

MEASURABLE INDICATORS	Statistics on pedestrian injuries
	Crime rates in areas before and after improvements are made
	Measure pedestrian usage

1. Massachusetts Highway Department. Massachusetts Highway Department Project Development and Design Guide. (2006). at <http://www.mhd.state.ma.us/default.asp?pgid=content/designGuide&sid=about>
2. Burdette, H. L., Wadden, T. A. & Whitaker, R. C. Neighborhood Safety, Collective Efficacy, and Obesity in Women with Young Children*. *Obesity* **14,** 518–525 (2006).

PUBLIC PLAZAS OR PIAZZAS

DEFINITION	A public space located in central areas that can be used for civic and commercial purposes. This area should be available for multiple uses and have a non-specific design.
JUSTIFICATION	Increases a sense of place in a neighborhood, provides an open space for congregating, and is a destination location.
EVIDENCE	People who have walkable destinations near their homes are more like to walk 30 minutes per day 5 days per week than people who do not. [1]
STRATEGIES	public spaces should be accessible to everyone including cyclists and pedestrians, exclude cars, be safe, have space to congregate, be memorable, be vibrant places for commerce, promote human use and comfort, promote healthy lifestyles, be ecologically sustainable, create convenient connections, be attractive, accessible, inviting and well-cared for, and create attractive and engaging street environments[2, 3]
OTHER CONSIDERATIONS	incorporate temporary and/or permanent art installations[2]
	organize pedestrian oriented programs, charity walks, vehicular street closings[2]
	increase # of outdoor cafes to enhance street activity[2]
	Locate plazas along popular pedestrian streets and near transit stops[2]
MEASURABLE INDICATORS	

1. Pierce, J. R., Denison, A. V., Arif, A. A. & Rohrer, J. E. Living near a trail is associated with increased odds of walking among patients using community clinics. *Journal of Community Health* **31,** 289–302 (2006).
2. New York City. Active Design Guidelines: Promoting Physical Activity and Health in Design. (2010). at <http://centerforactivedesign.org/dl/guidelines.pdf>
3. San Francisco Board of Supervisors. San Francisco Better Streets Plan: Policies and Guidelines for the Pedestrian Realm. (2010). at <http://www.sf-planning.org/ftp/BetterStreets/proposals.htm#Final_Plan>

PUBLIC TRANSIT

DEFINITION	The operation of a vehicle for use by the public which has a regular and consistent schedule and route.[1]	
JUSTIFICATION	According the American Public Health Association, access to and use of public transit increases physical activity and improves community cohesion, reduces pollution as well as fatalities and injuries.[2]	
EVIDENCE	Public transit produces less air pollution per passenger mile than automobiles: 95% less CO, 92% fewer VOCs, and about half the CO_2 and NO_x [3, 4]	
	The fatality rate, per 100 million miles, for public transportation is 1/25th the rate for automobiles[4]	
	Results from a study in Australia showed that men who used public transit were 45% less likely to be obese or overweight[5]	
	Another study found that people using public transit could lose more body fat than those commuting by automobile (1 pound of body fat over a six week period)[6]	
STRATEGIES	Transit routes should be well connected to pedestrian routes and sidewalks, provide convenient connections or access to residences, workplaces and other destinations[7]	
	Place transit stops on well-connected streets[7]	
	Stops should enhance the experience of waiting for and boarding transit vehicles[6]	
	Considerations should be given to the location of stops, stations, and other intermodal facilities[7]	
	Locate buildings and their entrances near transit stops and along transit corridors.[7]	
	Stops should be in areas that are active and visible to maximize safety and security of waiting passengers[6]	

OTHER CONSIDERATIONS	Provide signage including maps, distances, wait times, routes, and calories burned to next stop[7]
	Provide other community signage such as street names, maps and access to transit[7]
	Encourage transit use by providing pedestrian conveniences such as wide and accessible sidewalks with enough space for people to wait at transit stops (use curb extensions when possible)[7]
	Transit stops should be on the median for transit that uses the center lane[6]
	At signalized intersections, transit stops should be at the far side of the intersection, for intersections with stop signs, stops should be on the near side of intersections with traffic signals[6]
	Driveways should not be transit stops[6]
	Good transit stop layout gives passengers visual clues as to where to wait, allows ease of access between the sidewalk and the vehicle and does not block the adjacent sidewalk[6]
	A representative bus should be used as the design vehicle during the design phase[8]
	Pedestrian accessibility and connectivity needs to be ensured with cut ramps and accessible drop offs[8]
	Sidewalk/curb height needs to be appropriate for buses equipped with lifts[8]
	Dedicated lanes for transit vehicles[8]
MEASURABLE INDICATORS	Transit usage
	Accessibility to transit
	Air pollution
	Asthma rates

1. FTA - Research & Technology - Interpretations of Definitions. at <http://www.fta.dot.gov/12351_8874.html>
2. American Public Health Association. Public Transportation; A link to Better Health and Equity. at <http://www.apha.org/NR/rdonlyres/195825EE-2052-4C6D-911D-521091A11A5A/0/APHAPublicTransportationFactSheetMarch2012.pdf>
3. American Public Transportation Association & Public Transportation Partnership for Tomorrow. The Benefits of Public Transportation; The Route to Better Personal Health. (2002). at <http://www.apta.com/resources/reportsandpublications/Documents/better_health.pdf>
4. American Public Transportation Association. Public Transportation: Benefits for the 21st Century. (2007). at <http://www.apta.com/resources/reportsandpublications/Documents/twenty_first_century.pdf>
5. Zheng, Y. The benefit of public transportation: Physical activity to reduce obesity and ecological footprint. *Preventive Medicine* **46,** 4–5 (2008).
6. San Francisco Board of Supervisors. San Francisco Better Streets Plan: Policies and Guidelines for the Pedestrian Realm. (2010). at <http://www.sf-planning.org/ftp/BetterStreets/proposals.htm#Final_Plan>
7. New York City. Active Design Guidelines: Promoting Physical Activity and Health in Design. (2010). at <http://centerforactivedesign.org/dl/guidelines.pdf>
8. Massachusetts Highway Department. Massachusetts Highway Department Project Development and Design Guide. (2006). at <http://www.mhd.state.ma.us/default.asp?pgid=content/designGuide&sid=about>

SHARED USE PATH

DEFINITION	A bikeway that is physically separated from motorized vehicular traffic. In addition to bicyclists, it may be used by pedestrians, skaters, wheelchair users, joggers and other non-motorized users.[1]
JUSTIFICATION	Shared use paths offer the benefit of continuous and extended recreation and transportation opportunities with a reduction in interactions between users and motorized vehicles. This type of facility accommodates users of all abilities.
EVIDENCE	Studies have shown that shared use paths have higher rates of usage when they are located in areas of higher population density, go through areas of commercial use, have vegetative health, and longer lengths of street segments in the network. Shared use paths which are in neighborhoods with the more adults over 64 or children under 5 years of age have lower rates of usage. [2]
STRATEGIES	Paths are an important part of bicycle and pedestrian networks and can complement good on-street connectivity.
	Shared-use paths should provide same connectivity as roadways but should be separated from the road.
	Further develop greenways and regional routes that are developed into the park system.
OTHER CONSIDERATIONS	Must comply with CMR 521 standards for slope/ramp/handrail requirements.
	AASHTO recommends paths that are at least 10 feet wide to accommodate multiple users traveling in both directions.[1]
	High traffic road crossings should have bike and pedestrian activated signals, median refuges at wide crossings, and warning signs for motorists and path users.[3]
	Should be visible from the street or nearby buildings for safety[3]
	Detailed design guidance for shared use paths is provided by Mass Highway in Chapter 11 of the Design Guide: http://www.mhd.state.ma.us/default.asp?pgid=content/designGuide&sid=about[4]

MEASURABLE INDICATORS	Path use
	Path accidents/injuries

1. American Association of State Highway and Transportation Officials. Guide for the Development of Bicycle Facilities. (1999). at <http://safety.fhwa.dot.gov/ped_bike/docs/b_aashtobik.pdf>
2. Lindsey, G., Han, Y., Wilson, J. & Yang, J. Neighborhood correlates of Urban Trail Use. *Journal of physical activity & health* **3,** S139–S157 (2006).
3. National Center for Bicycling and Walking. Increasing Physical Activity Through Community Design; a Guide for Public Health Practitioners and Livable Community Advocates. (2010). at <http://www.bikewalk.org/pdfs/2010/IPA_full.pdf>
4. Massachusetts Highway Department. Massachusetts Highway Department Project Development and Design Guide. (2006). at <http://www.mhd.state.ma.us/default.asp?pgid=content/designGuide&sid=about>

STREET CONNECTIVITY	
DEFINITION	A measure of how often streets and roadways connect and/or the spacing of intersections.
JUSTIFICATION	Connectivity promotes physical activity by creating more route options and shorter routes to destinations.
EVIDENCE	Researchers have found a positive association between increased physical activity and increased street connectivity.[1]
OBJECTIVE	The overall goal is to encourage walking and biking by increasing street connectivity and creating smaller block sizes for a safe more pedestrian-friendly street system. This can be done by incorporating some or all of the following:
STRATEGIES	Improve connectivity with existing streets by adding sidewalks, paths, stairs, ramps, gates, etc. to link dead ends and cul-de-sacs[2, 3]
	Add pedestrian pathways in existing neighborhood where connectivity is poor (intersections should be every 200-300 ft)[2]
	Include connectivity with public transit[3]
	Offer more choices along quieter streets[3]
	Reduce the need for wide difficult to cross streets and intersections by providing more connections[3]
	Design future developments with improved circulation patterns within and between neighborhoods[3]
OTHER CONSIDERATIONS	Maintain a constant sidewalk for ADA compliance[2]
	Avoid pedestrian or bicycle over- or underpasses that force a user to change levels[2]
	Minimize the use of mid block vehicular curb cuts in areas with heavy foot traffic[2]
	Design driveways and ramps to minimize contact between cars and pedestrians[2]

OTHER CONSIDERATIONS CONTINUED	Disperse motor vehicle traffic with more 2-lane commercial streets, which relieves traffic from arterial streets making streets safer for peds
	Maintain pedestrian connectivity when a street is severed[3]
MEASURABLE INDICATORS	Number of intersections per square mile

1. Berrigan, D., Pickle, L. W. & Dill, J. Associations between street connectivity and active transportation. *Int J Health Geogr* **9,** 20 (2010).
2. New York City. Active Design Guidelines: Promoting Physical Activity and Health in Design. (2010). at <http://centerforactivedesign.org/dl/guidelines.pdf>
3. Federal Highway Administration. How to Develop a Pedestrain Safety Action Plan. (2008). at <http://safety.fhwa.dot.gov/ped_bike/ped_focus/docs/fhwasa0512.pdf>

STREET AND STREETSCAPE DESIGN

DEFINITION	The layout and design of individual streets and street segments, including the street surface; roadway lanes for travel by vehicle or bicycle; parking; medians; sidewalks; objects on the sidewalks; and all space up to the private property lot line.[1]
JUSTIFICATION	Streets can help define character of the area. Street design is an important built environment factor associated with active transportation, especially walking and biking. [2]
EVIDENCE	People who live near goods and services are more likely to walk and meet the daily physical activity requirements.[3]
STRATEGIES	Roadway system should accommodate all users including pedestrians of all abilities, bicyclists, drivers, and passengers[4, 5]
	Improve compliance of all roadway users with traffic controls and laws[6]
	Slow vehicle speed[7]
	Improve visibility of pedestrians and motorists[7]
	Review community development standards and regulations to identify obstacles to changes and improvements, determine possible incentives and encourage redevelopment of property along existing roadways with poor design features[8]
	Provide pedestrian facilities where the need is the greatest by establishing a routine system to identify gaps in the network along streets and highways, particularly in urban and suburban areas[7]
	Future development projects should include streetscaping aspects and prioritize pedestrian improvements in commercial business districts to increase business and a sense of place[4]
	Streetscapes should be appropriate for the street type[6]
	Create multimodal infrastructure that supports transit use[4]

OTHER CONSIDERATIONS	Sidewalks width or bump outs should accommodate trees, utilities, plantings, street lights, parking meters, bike racks, benches, and refuse barrels so as not to block the pedestrian path[5]
	Community goal to reduce automobile traffic[4]
	For some communities it may be appropriate to require sidewalks in community regulations[4]
	Reduce street crossing distance for pedestrians[7]
	Incorporate traffic calming measures on local streets[4]
	Identify service gaps and areas with deficiencies in access for people of differing abilities
MEASURABLE INDICATORS	

1. Frank, L. D., Engelke, P. O. & Schmid, T. L. *Health and community design : the impact of the built environment on physical activity*. (Island Press, 2003).
2. Sustainable Communities Index - Indicator T.1.c Time spent walking or biking. at <http://www.sustainablesf.org/indicators/view/45>
3. Pierce, J. R., Denison, A. V., Arif, A. A. & Rohrer, J. E. Living near a trail is associated with increased odds of walking among patients using community clinics. *Journal of Community Health* **31,** 289–302 (2006).
4. Beck, C. Healthy Communities: the Comprehensive Plan Assessment Tool. (2010). at <http://www.ipa.udel.edu/healthydetoolkit/docs/CompPlanAssessmentTool.pdf>
5. Massachusetts Highway Department. Massachusetts Highway Department Project Development and Design Guide. (2006). at <http://www.mhd.state.ma.us/default.asp?pgid=content/designGuide&sid=about>
6. San Francisco Board of Supervisors. San Francisco Better Streets Plan: Policies and Guidelines for the Pedestrian Realm. (2010). at <http://www.sf-planning.org/ftp/BetterStreets/proposals.htm#Final_Plan>
7. Federal Highway Administration. How to Develop a Pedestrain Safety Action Plan. (2008). at <http://safety.fhwa.dot.gov/ped_bike/ped_focus/docs/fhwasa0512.pdf>
8. Environmental Protection Agency. *Essential Smart Growth Fixes for Rural Planning, Zoning, and Development Codes*. 52 (2012). at <http://www.epa.gov/dced/pdf/rural_essential_fixes_508_030612.pdf>

TRAFFIC CALMING

DEFINITION	Use of design features and strategies to slow vehicle traffic speeds and volume.
JUSTIFICATION	Vehicle speed plays a large role in the severity of injuries to the pedestrian, cyclist, driver and passengers in an accident. Driver reaction time is lowered and the force of the impact is greater at higher speeds.[1]
EVIDENCE	Pedestrian injuries can be reduced more than seven fold by lowering the speed limit from 30 mph to 20 mph. Hit by a car travelling 40 mph a pedestrian has an 85% chance of being killed. When the vehicle is travelling at 30 mph the chance is reduced to 45%, and the fatality rate drops to about 5% when the vehicle is going 20 mph or slower.[2, 3]
STRATEGIES	Reducing speed limits to a level appropriate for the street's context and reducing the number of motorists speeding on the road will promote walking and bicycling by improving pedestrian and cyclist comfort.[4, 5, 6]
OTHER CONSIDERATIONS	Studies have shown that integrating traffic calming measures into street networks and the use of multiple calming methods has the greatest effectiveness on slowing traffic.[7]
	Roads should be as narrow as possible with a minimum number of lanes[4, 6]
	Incorporate bump outs, curb extensions, medians, islands, lane offsets, raised speed humps, raised crosswalks, curved roadway alignment (chicanes), low speed intersections, signal phasing, textured pavement (rumble strips) or signage for pedestrian awareness[4, 5, 6]
	Restrict vehicle movement with street design, medians directing traffic, channelizing islands, turn restrictions or no turns allowed[6]

MEASURABLE INDICATORS

Number of accidents

1. Sustainable Communities Index - Indicator T.2.d Speed limit compliance. at <http://www.sustainablesf.org/indicators/view/49>
2. Ewing, R. & Dumbaugh, E. The Built Environment and Traffic Safety: A Review of Empirical Evidence. *Journal of Planning Literature* **23,** 347–367 (2009).
3. Stair, P., Wooten, H. & Raimi, M. How to create and implement healthy general plans. (2008). at <http://changelabsolutions.org/sites/default/files/Healthy_General_Plans_Toolkit_Updated_20120517_0.pdf>
4. New York City. Active Design Guidelines: Promoting Physical Activity and Health in Design. (2010). at <http://centerforactivedesign.org/dl/guidelines.pdf>
5. San Francisco Board of Supervisors. San Francisco Better Streets Plan: Policies and Guidelines for the Pedestrian Realm. (2010). at <http://www.sf-planning.org/ftp/BetterStreets/proposals.htm#Final_Plan>
6. Massachusetts Highway Department. Massachusetts Highway Department Project Development and Design Guide. (2006). at <http://www.mhd.state.ma.us/default.asp?pgid=content/designGuide&sid=about>
7. Ewing, R., Lawrence, F. & Kreutzer, R. Understanding the Relationship Between Public Health and the Built Environment. (2006). at <http://www.usgbc.org/ShowFile.aspx?DocumentID=3901>